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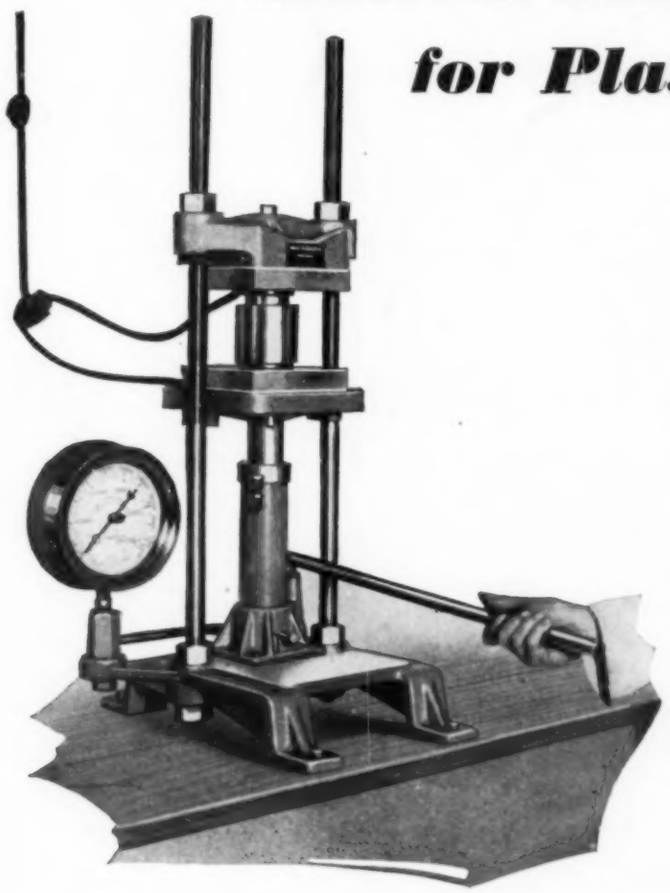

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PLASTICS & MOLDED PRODUCTS

Reg. U. S. Pat. Off.

Volume 7 **FEBRUARY 1931** **Number 2**

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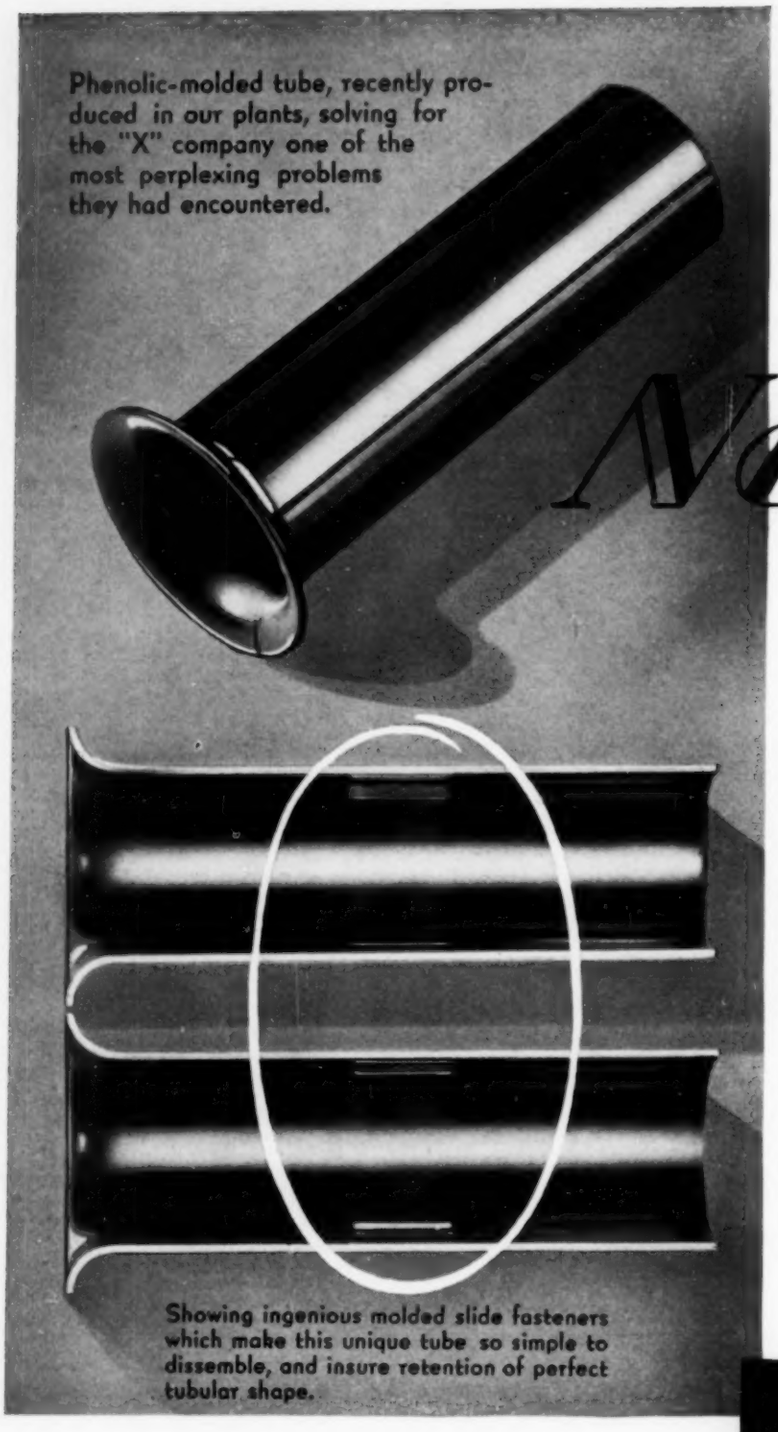
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PLASTICS & MOLDED PRODUCTS
Reg. U. S. Pat. Off.

Volume 7 FEBRUARY, 1931 Number 2

Molded Telephone Parts

A description of the presses, auxiliary equipments, tools and materials used in mass production molding

By A. M. Lynn
Western Electric Company

THE Western Electric Company now manufactures for Bell System apparatus a large number of different phenol-plastic, shellac, and hard-rubber molded parts, the output of which varies from a few thousand to several million per year. The majority of these molded parts are produced in comparatively small quantities, but certain of them, such as the phenol-plastic molded parts used in the hand-set type of telephone, a new molded subscriber's set housing, and the receiver shell, cap, and mouthpiece used on the older type of desk-stand telephone, are heavy-running parts. The tools and press equipment used in the production of these parts are described in this paper.

The phenol-plastic molded parts for the hand-set type of telephone used by the Bell System constitute the largest class of plastic molded parts now produced for telephone use. The hard-rubber receiver shells and caps and shellac-composition mouthpieces for the desk-stand and wall types of telephone formerly constituted the largest class of plastic molded parts made for telephone apparatus and, with the exception of shellac-composition mouthpieces, are still second in quantity of out-put. The shellac-composition telephone mouthpiece used for many years is now being replaced by a similar phenol-plastic part and the output of this single part is now several million per year, most of which are used for replacing shellac-composition parts now in service. The hand-set telephone and the hard-rubber receiver shell and cap are too familiar to call for illustrations. The molded subscriber's set housing, which has replaced the older drawn-steel housing, is illustrated in Fig. 1 and will be reproduced at a rate of more than one million per year. This part weighs about 10 ounces and is a good example of high production of a fairly large plastic-molded part.

Reprinted, with permission, from MECHANICAL ENGINEERING, October, 1930.

Hydraulic-Press Equipment

The hydraulic-press equipment of the plastic-molding plant used for the production of the above-mentioned and other plastic-molded telephone parts contains a number of different classes of hydraulic presses varying in capacity from 15 to 350 tons. In the following classification of the different types of presses used, the parts produced on them are also described.

Inverted Semi - Automatic Presses. A number of presses of this class, varying in capacity from 15 to 125 tons, are used for the production of a large number of different phenol-plastic and shellac molded parts, the requirements of which are moderate. The molds used on these presses are of the so-called "semi-positive" type, channeled for steam and water, and containing generally from 1 to 10 cavities.

Tilting-Head Presses. This class consists of a number of tilting-head presses of conventional design, varying in capacity from 70 to 150 tons, which are used principally for the production of the hand-set telephone handle which is, at present, the most complicated high-production part. One of these presses, equipped with hand-set-handle mold, is shown in Fig. 2.

Gas-Heated Presses. A number of 60-ton multiple-platen gas-heated presses are used for the production of hard-rubber parts molded from hard-rubber dust. The most familiar example of a part produced in this manner is the desk-stand telephone receiver cap, the method of manufacture of which will be described later. For each gas-heated press a duplicate multi-

ple-platen water-cooled cooling press is provided for cooling the molds which are transferred to it by hand.

Duo-Presses. The present equipment of this type of press, which is a special Western Electric design, consists of two 150-ton, eight 250-ton, and four 350-ton capacity presses. This type of press, one of which is shown in Fig. 3, is, as its name implies, two presses in one, having a heating station at the rear of the press, a cooling station at the front, and a table which revolves around a central column for transferring the molds from one station to the other. The heating station consists of an upper stationary steam- or electrically heated platen and a similar lower heated platen which is raised by the main hydraulic ram of the press and lowered by hydraulic pull-backs. When the press is closed at the heating station, the mold is lifted from the revolving table and pressed against the upper heating platen. The mold is thus heated by conduction from the two platens between which it is held. The cooling station is similar to the heating station except that the upper platen is attached to a tilting head which is equipped with jaws for lifting the upper half of the mold. A subpress ram at the cooling station, of somewhat lower capacity than that of the main ram, is used to close and open the molds. The platens at the cooling station are channeled for water cooling. This type of press is now used for the manufacture of all the high-production phenol-plastic parts now used in Bell System apparatus with the exception of the hand-set telephone handle.

The principal advantages of this design of hydraulic press may be briefly stated as follows:

1 High production per unit of floor space and economy in consumption of steam and water.

2 The advantage of the tilting-head construction with higher capacity than is available in other tilting-head-type presses.

3 Low first cost and low maintenance cost of molds, owing to omission of steam and water channels, with resultant reduction in mold deterioration from shrinkage cracks caused by the rapid temperature changes present in direct-heated molds.

Hydraulic Pumps and Accumulators

The molding plant is equipped for three different hydraulic pressures, 300, 1000, and 2500 lb. per sq. in. The 300- and 1000-lb. hydraulic pressures are supplied by pumps and weight-loaded accumulators of conventional design. The 2500-lb. hydraulic pressure is supplied by two 18-g.p.m. triplex pumps and a high-pressure pneumatic-type accumulator. The motor-driven three-cylinder hydraulic pumps force water into a vertical accumulator cylinder containing a floating piston, against the opposite side of which a pressure of 2500 lb. per sq. in. is exerted by the air in the steel air bottles or cylinders.

The operation of this accumulator can be readily described with the aid of the diagrammatic sketch shown in Fig. 4. The space and connecting pipes occupied by high-pressure air are shown unshaded and that occupied by water, shaded. The piston in the accumulator cylinder rises or falls in proportion to the difference in the amount of water drawn from the system and the amount replaced by the pumps. The movement of this piston controls the pumps which suppy additional water as required. The pumps run continuously and are equipped with Holveg synchronized controls which, by lifting the suction valves, control the amount of water pumped into the accumulator cylinder and the connecting hydraulic lines.

In starting this equipment the original charge of air is pumped into the air bottles from the compressor, shown in the lower left-hand corner of Fig. 4, until the desired pressure is reached, after which only a small additional amount of air is needed about once a month to replace losses. This equipment has been in use about three years and from the standpoint of moderate first cost, low maintenance costs, and freedom from operating troubles has been quite satisfactory.

Manufacture of Phenol-Plastic Parts

The production methods used in the manufacture of certain of the heavy-running plastic molded parts previously mentioned will now be described and the most complicated part, the hand-set telephone handle, will be considered first. This part is irregular in shape and contains seven metal inserts and two circuit wires per part.

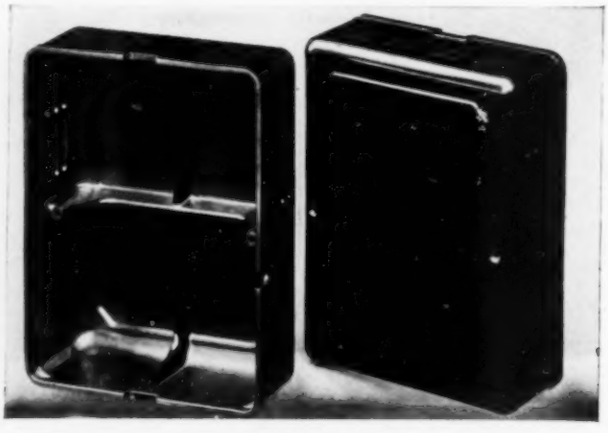


Fig. 1. Phenol Plastic Molded Subscriber's Set Housing.

The mold details constituting the mold cavities for these parts are made from a 90-point carbon, 1.20-per-cent manganese low-shrink, oil-hardening tool steel. The principal consecutive operations in the manufacture of the parts of a single cavity of one of these molds are shown in Fig. 5. It will be noted that the upper and lower halves of this mold part along a flash line around the side of the handle

Fig. 2. Tilting-Head Press with Hand-Set Handle Mold.

Fig. 3. Hydraulic 250-ton Duo-Press.

and that the mold cavity itself, with the exception of the round-end cavities at the end of the bottom half, consists of an irregular curved surface somewhat difficult to duplicate readily. The method of machining these cavities is briefly as follows: The first step in preparing for the manufacture of duplicate molds for the production of handles in quantity was the manufacture of two hardened-steel master hobs, one a duplicate of the lower half of a hand-set handle up to the flash line, the other a duplicate of the upper half of the handle. The curved surfaces of these master hobs were developed by shaping the surface to fit metal templates containing the cross-sectional contour of the handle at different positions along its major axis. The master hobs were then hardened and used as master templates for the development of the mold cavities in the production molds. The mold cavities for this part are not made by the so-called "hobbing" process, which would be impracticable with steel of the

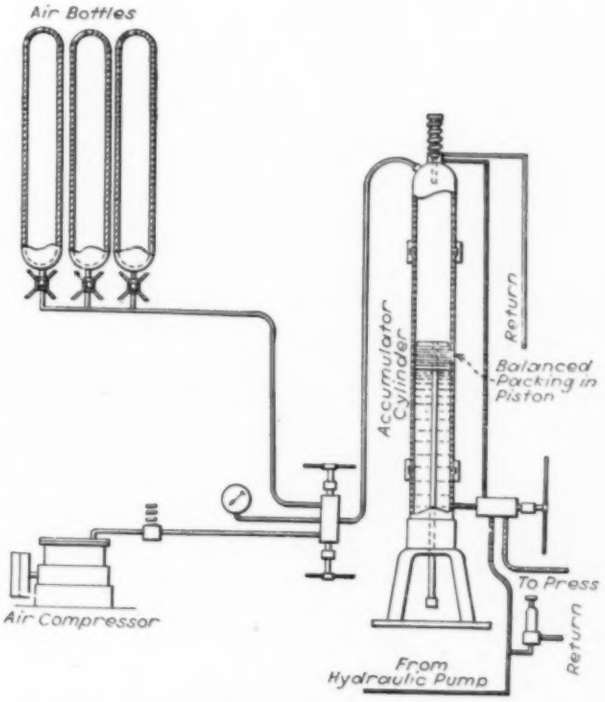


Fig. 4. Diagrammatic Sketch of Pneumatic Accumulator.

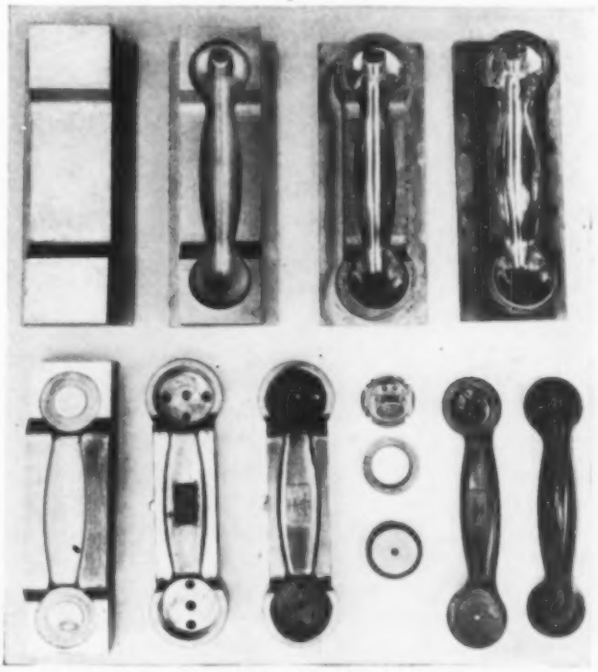


Fig. 5. Hand-Set Handle Mold Details in Different Stages of Manufacture.

composition used for these molds, but are machined, principally on Keller engraving machines, from master cavities. The mold cavities are rough machined on a Keller electrically controlled automatic engraving machine, after which they are finish machined to within about 0.005 in. of their final size on a Keller mechanical engraving machine. The cavities are then scraped by hand using the master hob, previously mentioned, with Prussian blue to locate the high spots on the surfaces.

Fig. 6. Receiver-Shell Molds, Cores and Unvulcanized-Rubber Blanks.

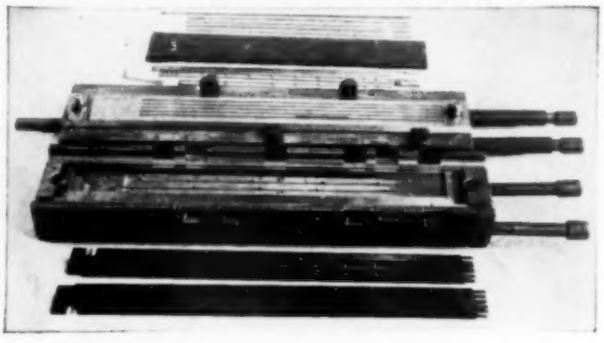


Fig. 7. Flash-Type Mold and Shellac Composition Panel Dial-System Commutators.

This process is carried to a point where a fairly well distributed uniform contact is obtained between the surface of the master hob and the mold cavity after which the cavity surfaces are polished preparatory to hardening. All the machine work such as drilling of holes and recesses for details is completed of course, before the polishing and hardening of the mold cavities. These mold details are then hardened by heating to approximately 1450 deg. fahr. in molten sodium cyanide and are quenched by slowly immersing the part, hanging lengthwise, in oil. The oil and cyanide are cleaned from the hardened part by boiling in water, after which the part is preheated to a moderate temperature and tempered by immersing it in a molten bath of Houghten's 275-deg. salt maintained at a temperature suitable for producing a final hardness of Rockwell C-58 to 62. The hardened parts are ground all over to final dimensions with the exception of the cavity surfaces which are polished with abrasives of increasing fineness, ending with a final polishing with Triple-X Alundum. Each of the production molds contains eight cavities, and the plungers containing the upper half of the cavities are mounted on a steel plate suitably channeled for heating and cooling. The lower half of the mold consists of a steel block approximately 6 in. thick, suitably channeled for steam and water, containing the cavities into which the details constituting the bottom portion of the mold cavities fit. This type of mold is mounted in a 150-ton tilting-head press and the molding cycle consists of a 6½-min. curing period at a temperature of 340 deg. fahr. and a 2½-min. cooling period.

The metal inserts for the handle are assembled in the smaller removable details which are then placed in the two end cavities of the bottom half of the mold. This bottom-half detail of the mold is then placed in the cavity in the mold chase and a measured amount of phenol-plastic molding powder added.

The press is closed and the part cured as previously described under a pressure of about 2000 lb. per sq. in. After the required curing and cooling, the mold is opened and the bottom detail of the mold, together with the molded handle, removed to the bench for dismantling. The molded part is finished by buffing and polishing operations which remove the fin left at the parting line of the mold.

The six other high-production molded hand-set parts, which are smaller and somewhat simpler to mold than the handle, are molded on duo-presses, as is also the molded subscriber's set housing and the desk-stand telephone-transmitter mouthpiece. The method of molding the transmitter mouthpiece will be described as the process of molding is, in general, representative of the methods used on the other hand-set telephone parts. Fig. 3 shows a duo-press equipped with transmitter mouthpiece molds. The mold cavities are charged with equal portions of molding compound and the press is closed. At the end of the curing cycle, which in the case of this part is 4 min., the parts are ejected from the lower half of the mold by raising, with the aid of the subpress ram, the sliding fixture shown at the left side of the press in Fig. 3 which contains a series of ejecting pins which enter holes in the bottom of the mold and raise the threaded mold details carrying the molded parts. These are then removed from the mold with a handling fixture. The details are unscrewed from the molded parts with the aid of motor-driven fixtures. The mouthpieces carry molding "flash" around the rim of the large end and also across the small holes in the grid at the threaded neck. This flash at both ends is removed in a single operation with a special fixture. Forty-nine parts per heat are produced and the output per hour per press is therefore about 735 pieces. The annual output of this part is several million,

(*Continued on page 102*)

Molded Mica Products Now Being Made with Complex Resinoids

British inventor employs phenol-urea-aldehyde resins for bonding this mineral

WITH the advent and further development of the urea-formaldehyde resins, now usually termed "aminoplastics", it was to be more or less expected that various inventors would sooner or later make attempts to combine the two types of condensation products into the same synthetic resinoid; and such in fact has been the case. Usually the products are described by themselves, but it appears that occasionally one can "get away" with hiding such an invention under a title not at all suggestive of what the invention really comprises.

Arthur Lloyd, of the Bakelite Limited, London, England, the British branch of the Bakelite industry, describes the making of mica sheets and tubes in which the binder consists of a condensation product of urea, phenol and formaldehyde. In his U. S. P. 1,784,737; Dec. 1930, (filed in Gt. Britain Aug. 15, 1927) he describes his process as follows:

For the manufacture of mica tubes and sheets by building up by means of a binder from mica flake for the purpose of insulation, natural and certain synthetic resins have been used in the past.

Deficiencies of Older Types of Resins

In the case of natural resins such as shellac, the finished products have the disadvantage of being softened by appreciably low temperatures, e. g. between 70 and 100° C. It is then an easy matter to slide the laminations one over the other. As the temperature rises decomposition sets in.

Certain other types of synthetic resins have been used, such as those manufactured from glycerine and phthalic acid but the process involved in building up tubes and sheets using these resins is a lengthy process and requires comparatively high temperatures or a long period of heating to make them infusible.

It is well-known that phenol-formaldehyde resins are not satisfactory for this purpose as there is a lack of adhesion between mica and such binders which causes tubes and sheets so made to readily flake and break apart when stoved. Of the theory of this action of flaking and breakage the inventor is not certain, the action is possibly due to the presence of a water film in spaces between the resin and the mica.

Urea-phenol-aldehyde

It has been found that a phenol-urea-formaldehyde resin, has considerable advantage over many other natural or synthetic resins for the purpose of binding mica flakes together.

According to the present invention the manufacture of tubes, plates or sheets containing mica comprises the following steps in the order in which they are named:—

(a) Taking a layer of mica and spreading upon it or dipping it into a solution of a phenol-urea-aldehyde condensation product and thereby forming a continuous sheet or layer compounded of the mica and the solution;

(b) Evaporating the solvent and partially hardening the phenol-urea-aldehyde product by heating sufficiently to prevent sticking when the sheets are stored in stacks.

The sheet or layer compounded of the mica and the solution partially hardened may be submitted to a subsequent step which consists in moulding it to any desired shape by rolling onto a heated former or pressing into a heated mould and heating on the former or mould to the hardening temperature of the condensation product employed as a binder for a sufficient time to convert the latter into its insoluble form. The sheets of mica and partially hardened condensation product may also according to the invention consists of a plurality of layers and the layers of the plurality may be bonded together by the condensation product.

Furthermore according to the invention a plasticizer may be incorporated into the solution of condensation products before building up the sheets in order to make the material more flexible; such plasticizers may be used as those usually employed by the synthetic resin industry.

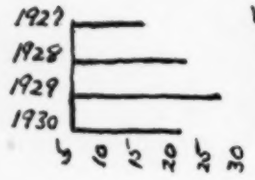
According to a preferred method of carrying out the invention the binder between the mica constituents of the article is a phenol-urea-formaldehyde condensation product whose constituents are in the following proportions by weight:—

	Parts by weight
Phenol	100
Urea	60
40% solution of formaldehyde in water	250

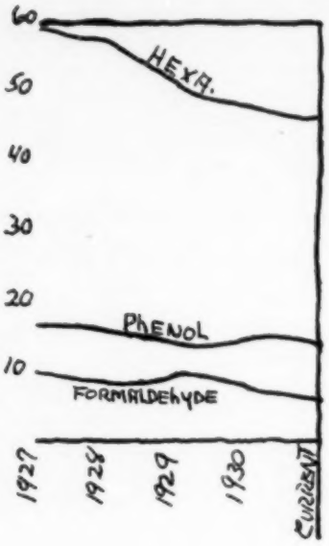
In carrying out the invention the following is one convenient mode of procedure:—The phenol-urea-formaldehyde condensation product is dissolved in ordinary industrial alcohol or any other suitable solvent or combination of solvents, thus mak-

(*Continued on page 98*)

PLASTICS & MOLDED PRODUCTS



LEFT:-
GROSS BILLINGS IN MILLIONS of DOLLARS-
CUSTOM MOLDERS



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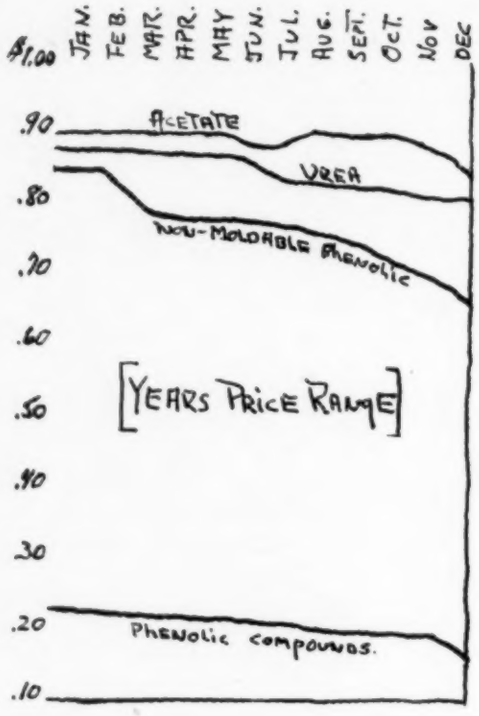
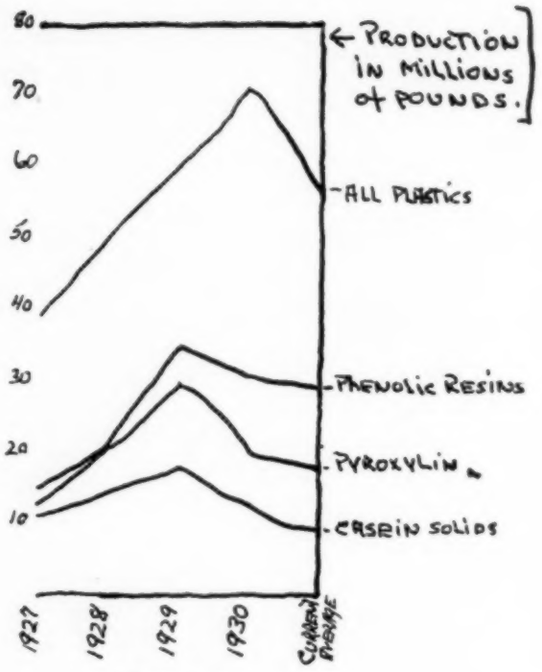
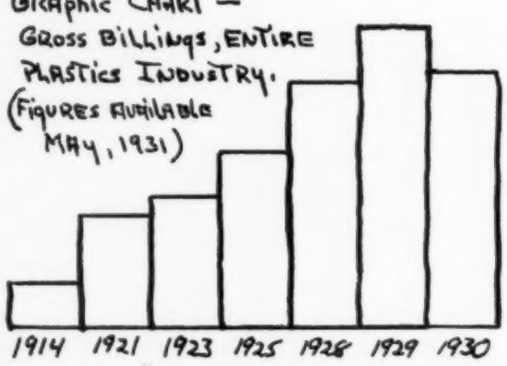
CHEMICAL PRICE RANGE; CENTS PER POUND.

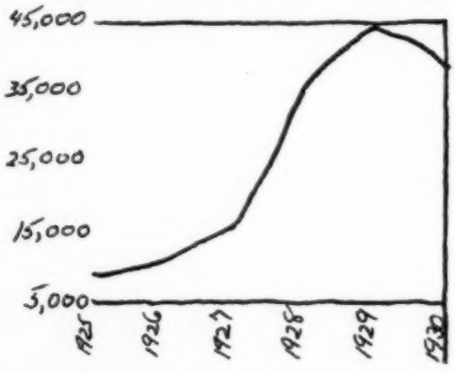




BELOW —
ENGLAND; IMPORTATION of RESIN; IN CWT.

Graphic CHART —
GROSS BILLINGS, ENTIRE PLASTICS INDUSTRY.
(FIGURES AVAILABLE MAY, 1931)





Plastics Industry Quite Steady Through 1930 Depression

Annual Trade Review

By R. C. Gilmore, Jr.
Plastics Publications, Inc.

IN such an unstatistical industry, it is virtually impossible to correctly correlate reputed facts and rumors into some sound, or even sane, review of business. There are, however, various indices which have acted as sign-posts throughout the past year and which, when impartially surveyed, can be rearranged into a positive guide of conditions and levels if taken into comparison with previous periods. To judge by standards other than those of the inflated year 1929, the Plastics Industry maintained its equilibrium to a better degree than most others. It was off less than general business, not quite as much as chemical industries generally, and remained firmer, from a price standpoint, in its commodities and supplies. Greater reductions in raw material have had their advent since Jauary 1, and while there was some reduction at the contract time, in the summer of 1930, this reduction was not so general as the more recent one and was, in proportion, much less.

Less Machinery Bought

It is our belief that 1930 was less than 8% below 1928 in everything but machinery, and this was probably lowered by one quarter. The first six months of the year held up extremely well, and it was only in the last half that retrenchments, lowered prices, increased inventories, and curtailed consumer requirements had a drastic effect. Molding powder, resin and sheet stock (with the exception of casein) reduced but 3% in the first six months as compared to the corresponding period of the previous year. Strangely enough, chemicals and fillers had an appreciably greater reduction in that time, and custom molding business had slightly less. Some governmental production figures have been available only recently and, as usual, carry only through 1929. We are appending these tables to this article.

European production was generally lower, in proof of which the trade in Japan may be referred to. One or two countries, notably Italy and France, kept at a steady level, but at this writing pessimism seems to have reached its new low and England and Germany are digging in for better times. However, our main thought is not concentrated upon Europe, since the past two issues have contained a valuable summary of conditions there by Dr. Pelikan.

Depression was much more acute in the smaller companies in this country, who were pinched for credit and were denied usual banking resources. One or two of the larger companies suffered from an inability to borrow for their needs, and as they had come to count very largely on loans during 1928 and '29, this was a severe setback and necessitated a reorganization of working methods. Two important facts stand out most clearly: 1.) quality production was steady, although gross billings receded; 2.) new fields and applications were developed extensively, and usually on the basis of a sound price policy.

Pyrox in plastics suffered a setback of nine million pounds, and since a great proportion of this was due to slack production in the automobile field, this can be expected to rebound favorably during the coming year. There is not much doubt but that film, especially in its newer forms, was the salvation of this industry, although aggressive sales promotion kept toiletware applications from going as low as had been expected. In the field of phenolic molding material, there was a net loss of about 5,500,000 pounds; and since the gains in cellulose acetates, ureas and other newer materials were offset by the losses in cold molding activities, the total production of these types was about 47,000,000 pounds, or a decrease of 37½% from 1929, and 8% from 1928. Laminated materials held up better than most, and the accompanying table will show the results in this branch of the industry.

(*Continued on page 112*)

Production in Phenolic Resins and Bases, in Lbs.
From U. S. Census of Dyes, 1929

	Phenolic Resins	Phenol		Formaldehyde	Hexamethylene tetramine	
	Production	Production	Imports	Production	Production	Imports
1927.....	13,452,230	8,041,082	500	29,920,072	1,315,213	3,417
1928.....	20,411,465	10,227,489	1,653	38,717,732	1,661,645	5,898
1929.....	33,036,490	24,177,618	443,385	51,786,422	2,368,020	5,562

Flexible Synthetic Resins---A Prediction Now Being Realized

Glycerol esters of the higher fatty acids impart new properties to the resinoid plastics

By Carl Marx

Compounds of adipic acid, sebacic acid and the like are used with phenolic resins in accordance with the principles of resinfication.

THE phenolic and other synthetic resins thus far prepared have, practically without exception, been rather hard and inflexible, with the result that the molded products prepared by their use have been rather brittle, and not sufficiently resistant to shock and impact. In the plastic field, therefore, the cellulose ester plastics such as the pyroxylin and cellulose acetate plastics have been preferred for such uses where elasticity and resistance to shock were essentials.

Many attempts have been made to modify the properties of the synthetic resin plastics, but very little has been published about it. It is only when some inventor finally obtains a patent that we get some hints of what lines research is pursuing in solving this problem. This is a peculiarity of our American situation, where the exigencies of commercial competition prevent publication of research work because of the quite natural fear that the competitor will thus gain an advantage. The further fact that it takes from three to any number of years of effort to get a patent application through the patent office retards dissemination of the progress realized. While we have often heard it stated that "one can't rely on what an inventor says in his patent", we can not subscribe to this statement. It is usually made by those who only read foreign patents, or United States patents filed from abroad, which usually are mere translation of a corresponding foreign application, and which is therefore of a more or less sketchy nature, for most of the foreign governments proceed on quite a different theory than we do in America. Abroad, one can patent what is practically nothing more than an "idea"; by which we do most emphatically however not wish to convey that thought that such patents are not valuable, nor that they are inoperative. What we mean is that the specification of a foreign patent is in general much shorter than those necessary for the grant of a valid patent in the United States, for here it is necessary to give so adequate a disclosure and discription that any one may manufacture the product or carry out the process described, at the end of the seventeen year period, without further experimentation. We therefore remain of the opinion that disclosures and descriptions in United States patents are much more likely to teach the patented process than are the corresponding foreign patents. The only advantage in following the foreign patents is the fact that they issue so much sooner than do the American patents, and that very often knowledge is thus acquired of what the trend of development is taking.

A Prediction

About 1923 we ventured the prediction that the day would come when synthetic resins could be so modified as to yield plastics of sufficient resiliency to serve for the production of flexible films such as are used in the motion picture and photographic industries (Chemical Age, 1924). It seems that present-day development is bearing out the prediction.

In this connection it is interesting to refer to two quite recent United States patents of Herman Alexander Bruson, who assigns them to The Resinous Products & Chemical Co. The first one deals with the production of flexible rubber-like synthetic resins, and the second to their use as plasticizers for synthetic resinoids such as phenol-formaldehyde and similar resins.

Elastic Resins

According to the first patent, elastic resins are produced from polybasic acids and glycerol (U. S. P. 1,779,367; Oct. 21, 1930).

It has been known in the past that many polybasic acids such as phathalic, succinic, glutaric, malic, maleic, malo-malic, furmaric, tartaric and citric, unite with polyhydric alcohols, notably glycerol, to form resins. Such reaction products are at first sirupy liquids but eventually become friable resinous masses of varying degrees of hardness. In every case they form brittle, hard resins when the condensation is carried to completion.

Certain higher polybasic acids which contain a minimum of six carbon atoms linked together in a straight chain, as for example in adipic acid, do not give such resins, but form soft, rubbery, plastic masses which are never hard, brittle, or friable. They possess great interest and practical value inasmuch as they are completely compatible with

nitrocellulose and other cellulose esters, and confer upon these substances the property of unusual flexibility, elasticity and toughness such as can not be duplicated by the use of other plasticizing or flexibilizing agents.

The above mentioned soft, elastic condensation products are formed when a polyhydric alcohol such as glycerol is heated preferably in molecular proportions with any one of the higher aliphatic dibasic acids containing at least six carbon atoms in a straight chain; these acids being any one of the following:

Acid	Formula
Adipic	HOOC—$(CH_2)_4$—COOH
Pimelic	HOOC—$(CH_2)_5$—COOH
Suberic	HOOC—$(CH_2)_6$—COOH
Azelaic	HOOC—$(CH_2)_7$—COOH
Sebacic	HOOC—$(CH_2)_8$—COOH

The condensation of these acids with a polyhydric alcohol takes place in three stages:

Stage "A".—Initial condensation product; thin sirup, soluble in acetone.

Stage "B". — Intermediate product; soft, flexible, tacky, rubbery mass; soluble in acetone or ethyl acetate, but insoluble in benzol.

Stage "C".—Final product; soft, flexible, elastic, very tough solid; insoluble in the common organic solvents.

In no case is a hard, brittle, or friable resin produced such as is obtained by heating polyhydric alcohols with the other polybasic acids of aliphatic or aromatic nature hitherto employed in the art.

The methods of preparation of soft, elastic condensation products may be briefly described as follows, it being understood that the reactions cited are typical for any one of the acids of the homologous series ranging from adipic acid to sebacic acid as mentioned hereinabove, and including any possible mixture of two or more of these acids.

Adipic Acid and Glycerol

1 mole equivalent glycerol (92 parts by weight) and 1½ mole equivalents adipic acid (219 parts by weight) are placed in a capacious vessel and heated in an oil bath gradually to 165-170° C. The temperature is kept at this point, removing samples from time to time, until a condensation product having the desired consistency is obtained. The period of heating depends upon the size of the batch. Considerable water and gases are evolved and it is desirable to employ stirring throughout the condensation process in order to obtain a uniform product. After a period of heating ranging from 1 hour to 5 hours at 165-170° C. a condensation product ranging from the soluble, "B" stage to the insoluble "C" stage is obtained depending upon when the reaction is stopped. The soluble form is usually complete at the end of 1½ hours, whereas if carried further, formation of the insoluble product sets in.

Sebacic Acid and Glycerol

The reaction of glycerol with sebacic acid is quite analogous to that of adipic acid and glycerol except that the higher molecular weight sebacic acid requires a longer time for reaction.

1 mole equivalent glycerol (92 parts by weight) and 1½ mole equivalents sebacic acid (303 parts by weight) are heated as above at 165-170° C. The mixture is carefully held at this point until a sample when removed sets to firm jelly on cooling. The length of time of heating for a batch using 1/5 of the above quantities, necessitates about 4½ hours to complete stage "A". At the end of 4¾ hours the "B" stage is completed, and further heating for ½ hour yields the insoluble "C" stage. The reaction may also be carried out at higher temperatures say at 190°-200° C. but the reaction is more difficult to control as the tendency is very great for the "B" stage to pass over into the "C" stage product. I have found that reactions carried out at lower temperatures for a longer period of time give a more uniform product.

Instead of adipic acid or sebacic acid any one of the other acids mentioned, namely, pimelic, suberic, or azelaic may be used in corresponding amount, to form condensation products having similar properties.

All of the soluble products obtained are compatible with nitrocellulose in butyl acetate-toluol solution and give therewith transparent, flexible films which are elastic and capable of being stretched to an extraordinary degree without the use of other plasticizing agents. They are considerably more water resistant than are the glycerol esters of the lower polybasic acids such as succinic, citric, etc.

Glycol Esters

Instead of glycerol, other polyhydric alcohols may be used such as polyglycerol diethylene glycol, triethylene glycol, and ethylene glycol. Quantities other than those indicated may also be used, although it is best not to deviate considerably from the theoretically calculated quantities necessary to react with all the hydroxy groups of the polyhydric alcohol. Diethylene glycol has a tendency to form dark colored products which are not as tough as those obtained from glycerol or polyglycerol. Ethylene glycol reacts very slowly and requires about 30 hours at 240° C. to yield a condensation product with sebacic acid.

The soluble "B" stage condensation products and the insoluble "C" stage products may be hardened by dissolving them in various natural and synthetic resins such as colophony, shellac, ester gum. Congo gum as well as in the reaction products of phenol and formaldehyde to yield hard resins which retain a certain degree of the toughness and flexibility inherent in the original "B" and "C" stage products described above.

Applied to Resins

How these products are employed to plasticize the phenolic resins is described in U. S. P. 1,783,611; Nov. 25, 1930.

If a solution of a phenol-for-

maldehyde resin is mixed with a solution of the above mentioned condensation products in suitable proportions, homogeneous solutions may be obtained which, upon evaporation of the solvent, deposit strongly adherent, tough, flexible films that remain flexible, even upon baking for a prolonged period of time. Such films in either the unbaked or baked state are insoluble in oils or hydrocarbons and may be used for coating oil-storage tanks where, on account of contractions and expansions of the tank, elasticity of the film is of prime importance. Suitable solvents for the above mixture are those which are capable of mutually dissolving both the phenol-formaldehyde resins and the rubbery, resinous condensation products. Acetone, alcohol, ethyl acetate and butyl acetate are appropriate solvents for this purpose.

Example

100 parts by weight of a soluble "Novolack" phenol-formaldehyde resin or "reactive" phenol-aldehyde resin is dissolved in 200 parts alcohol and mixed with 50 parts by weight of the soluble, rubbery condensation product prepared by heating glycerol with sebacic acid, which latter compound is described in my co-pending application bearing Serial No. 311,256. A clear solution is obtained, which upon evaporation of the solvent, deposits a tough, adherent, flexible film that is resistant to gasoline and oils.

The quantity of rubbery condensation product may be increased to give still more flexible and softer films, or it may be decreased to yield somewhat harder films. The films may be baked at 150° C. for several hours, whereby the rubbery plasticizer becomes insoluble without losing flexibility. An infusible, tough, elastic, insoluble coating upon metal may thereby be obtained if the reactive type phenol-formaldehyde resin is employed.

In place of the sebacic acid-glycerol condensation product, any of the soluble condensation products of a polyhydric alcohol with adipic, pimelic, suberic, azelaic acids or mixtures of these acids may be employed as described in the aforementioned application, Serial No. 311,256.

Resins other than the phenol-formaldehyde resins mentioned above may be similarly plasticized as described above. These include shellac, cresol-formaldehyde resins, ketone-formal dehyde resins and condensation products of phenol with furfural, and formaldehyde-urea resins. Other hard, brittle synthetic resins that are alcohol soluble may likewise be plasticized.

Instead of preparing a solution of the two resin components, the solid, hard, brittle resin may be powdered and mixed directly with the viscous, rubbery condensation products enumerated herein. This may be done in a mixer so as to obtain an impregnated powder or pasty mass that may be used for molding objects of practical value.

Molded Product from Slag and Resin

A rather strange sort of molded product is described by Samuel F. Walton, of Hamburg, N. Y., (assignor to Exolon Co., of Blasdel, N. Y., U. S. P. 1,781,204; Nov. 11, 1930). It consists of furnace slag that has been given a vitreous coating and then has been united by means of a phenolic resin into a molded product, preferably of a clear type so as not to hide the natural color of the slag and its vitreous coating. The inventor describes it in the following language:

"This product may be made in any color desired and for such color effects I proceed as follows. I use for a base or body for my product a silicate and for this purpose can utilize such a common and inexpensive material as furnace slag. Such a slag when comminuted furnishes a porous material of irregular surface. It is light and has a considerable structural strength and as a silicate offers an unusual possibility for a basis of bonding with an insoluble color vehicle such as a silicate.

"In producing a color for such a material I use a soluble silicate such as water glass mixing with this a metallic oxide of the desired color. The slag particles are then kneaded into this color mixture and the whole dried out while the mass is being constantly stirred or agitated. When dried out the mass is then brought to a temperature not exceeding 500° C. This effects a chemical union of the silicate in the presence of the metallic oxide whereby an infusible glaze is deposited on the slag particles and in all the pores thereof. Such material then constitutes in itself a color or colored body which I embody in a phenol condensation product, such as phenol resin, which acts as a bond throughout the material and produces a product of novel and advantageous characteristics. In doing this I wet the colored slag before described with any suitable solvent, as furfural, and add to this a phenol resin in finely powdered condition, mixing the mass thoroughly. Such a mixture may then be heated and molded under pressure as desired.

"When removed from the mold the article is again heated to a sufficient temperature to harden the resin to its insoluble condition. Various phenols resins may be used, such for example as bakelite or carboloid, as they are commercially known, resins may be used, such for should be of the clear type so that the color of the mass is not hidden by the resin.

"The resultant product is characterized by lightness of weight, beauty and impermeability of color, fire retardance, and unusual tensile strength and resistance to shatter and shock."

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10 East 40th Street, New York City

Bakelite Corporation Exhibit Occupies a Conspicuous Niche at the Color Exhibition.

MOLDED PLASTICS

are featured at the

Exhibition on Color

A temporary antidote for the depression which hovers over business this winter, with the possible threat of duller days to come, is to turn away from business cares for a few hours and visit the Exhibition on Color, Museum of Science and Industry, New York. For here business wears a particularly sunny aspect. It is dressed for exhibition in a Joseph's coat in which all colors of the spectrum are blended—lacking only, perhaps, the tinge of indigo blue which has lately darkened the financial outlook.

Of particular interest is this exhibition to members of the plastics industry, which is so closely allied with advances made in scientific and industrial fields. In fact, the permanency of color in resinoid applications has had much to do with the rapid increase in demand for color which has led scientists to recognize the third decade of this century as the real beginning of the color age.

Professor Charles R. Richards, of the Museum of Science and Industry, explains the purpose of the exhibition as follows:

"Because of the profound effects which color and its wise use may contribute to our lives, and the general appeal to all which color makes, the museum has undertaken to demonstrate to the public the great scientific and artistic advances recently made. For the first time, color will be presented not only from any one standpoint in a single field, but from the inclusive standpoints of the scientist, the artist, the psychologist, and the technician, and an endeavor made to correlate them. The exhibition will provide an opportunity for the general public to view concrete examples of the amazing range and diversity of color uses, and to see color processes rarely available outside the walls of laboratories and in complicated technical industries."

Two hundred outstanding scientific, industrial, and business organizations have cooperated with the museum to make possible this Exhibition on the Science and Art of Color. The exhibits are arranged in six major groups, following in logical progression from the initial group, illustrating the nature of color, on to groups illustrating color production, color as seen by the human eye, the measurement and specification of color, examples of color materials, and concluding with exhibits of color application. The displays range from exhibits of colored kitchen utensils, and other articles in the home, to clothes, decoration, reading material,

food products, and color in transportation, manufacturing and industrial processes.

The plastics industry is represented in this exhibit by the Bakelite Corporation display in which are included examples of color materials and color applications. An outstanding feature and color keynote is the brilliantly sparkling display of the amber colored initial resinoid. In the examples of colored materials are the molding powders, the lacquers, and enamels. A mounted set of color disks shows part of the wide range of Bakelite standard colors. Laminated panels indicate the demand for color in furniture and interior architecture. The molded and laminated color applications include both industrial and domestic products.

Molding for Modern Industry

Bakelite molded material also appears in the exhibit of the Arcturus Radio Tube Company, in the form of a housing for the Arcturus Photolytic Cell. The use of the photoelectric cell in color study makes it a valuable servant of the color age.

Many of the exhibits are visitor-operated. Switches and levers permit each observer to make his own demonstration. A color printing press is in actual operation, and daily demonstrations of instruments and apparatus are given.

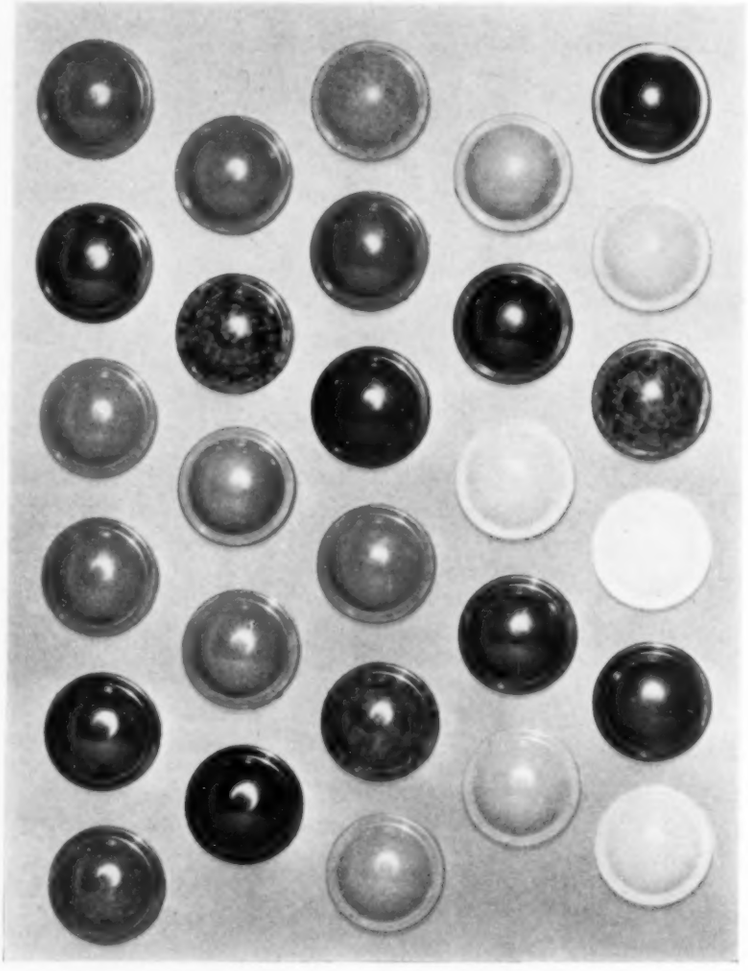
Guides explain the more complicated scientific items, and plans have been made for a series of lectures during the course of the exhibition by well known physicists, chemists, psychologists, artists, designers, illustrators, and others in the various fields of color.

Practical service is seemingly a watchword of this new museum. The present exhibition is conceived and dedicated to the principle that those who come as visitors must be well rewarded for their gift of time. Unlike the popular conception of the formal museum, the attitude of bated breath and rubber heels is here quite absent. The Museum of Science and Industry is an endowed institution, and, while it is in no sense a commercial undertaking, it is mindful of the value of interpreting commerce and industry. Thus, in the present instance, the museum has selected the subject of color as a most timely and important object for consideration by all of the great cross section of humanity. The importance of this project and its appeal have been nicely epitomized by Frederic B. Pratt, president of the museum. He says:—

"Color promises to transform entirely the outward aspect of our world, and will surely have its effect upon our inward life, our modes of thought, our attitudes and emotional life, and through them upon our actions.

"Color, too, promises to break the limitations of the machine age upon the products with which it surrounds our daily life. Color permits us to bring variety back again into a world which the machine might make too much alike. There is profitable study here for every one, for the layman, the psychologist, the student of sociology, the business man, the technician, and the general public."

The exhibition, which is free to the public, opened on January 20th, and will continue until the first of March. Museum hours are from 10:00 A. M. to 5:00 P. M. on week days only.



These sample pieces of Bakelite molded are typical of the foremost stand taken by the plastics industry in producing the varied and brilliant array demanded by the color age for its requirements of molded and laminated applications, lacquers and enamels.

Some New Means for Dissolving Cellulose

Dr. Leon Lilienfeld contributes further to a fertile field in which his activities have provided many most useful inventions

The production of fluid solutions of cellulose in quartenary ammonium solutions, ureas and guanidines is described.

These are readily reconverted in various shaped forms, and promise to be useful in the plastics industry.

THAT indefatigable worker in the field of cellulose and its plastics, Dr. Leon Lilienfeld, of Vienna, Austria, is still vigorously pursuing his researches on solvents for cellulose; particularly directing his attention to simplified processes that will yield inexpensive cellulosic solutions from which transparent cellulosic films and filaments can be produced by extrusion or forming on a film-wheel.

Departing from the time-honored viscose field, Dr. Lilienfeld now finds that quartenary ammonium bases, and ureas or thioureas, or guandine, in conjunction with alkalies, will, at very low temperatures convert almost any type of cellulose into a filterable solution, from which, after suitable clarification films or filaments can be formed.

Patent Long Delayed

The unfortunate circumstance that it takes about six years or more to get a patent application through the United States Patent office accounts for the fact that three of his patents on the above subject only issued on July 29, 1930, though filed in 1924, and in Austria in 1923. While the processes have of course reached the public through the corresponding Austrian patents, and other foreign patents, this is the first time details of the very interesting processes are available freely to American workers on this field. The first of the said patents, U. S. P. 1,771,461, employs ammonia derivatives of carbon dioxide in conjunction with caustic alkalies.

According to the particular nature of the body of the cellulose group, which is to be dissolved, the alkali solution in presence of the carbon dioxide derivatives dissolves the body, either at room temperature or at temperatures between room temperature and 0° C. or only below 0° C. In this respect, it may be taken as a rule, that with the same cellulosic body the solvent action of a more concentrated alkali solution occurs at higher temperatures than that of a more dilute solution and that with alkali lye of the same strength disintegrated cellulose passes into solution at higher temperatures than does that which is slightly disintegrated or not disintegrated.

In illustration of this behaviour, it may be stated as an example that in alkali solutions containing an ammonia derivative of carbon dioxide or of a sulphur derivative of carbon dioxide, those conversion products which may be obtained by separation from solutions of cellulose in suitable solvents (for instance strong mineral acids, ammoniacal cupric oxide, zinc chloride) or from viscose, dissolve, as a rule, even at room temperature; mercerized cellulose or highly bleached cellulose or bleached and mercerized cellulose dissolves round about 0° C. and sligthly disintegrated or not disintegrated cellulose only below 0° C. In any doubtful case it is easy to determine the proper temperatures by a simple preliminary test, namely by mixing the cellulosic body with an alkali solution (for example caustic soda lye of 10 per cent, strength) containing the said ammonia derivative of carbon dioxide or of a sulphur derivative of carbon dioxide and, if dissolution does not occur at room temperature, cooling by stages until a solution is produced which when spread on a glass plate and treated with dilute sulphuric acid forms a film fit for use.

Of the ammonia derivatives of carbon dioxide or of sulphurized carbon dioxide the following have proved particularly useful for the present process: Urea and derivatives thereof, thiourea and its derivatives, dicyanodiamide and its derivatives, guanidine and its derivatives, and urethanes.

As parent materials for the process there come into consideration:

(1) Bleached and unbleached cellulose of every kind and in every form in which it is available;

(2) Materials of every description containing cellulose;

(3) Cellulose conversion products of every kind, thus, for instance, the cellulose conversion products (probably cellulose hydrates) formed by mechanical comminution of the cellulose in presence of water;

(4) The cellulose conversion products obtained by treating

cellulose with oxidizing or reducing bleaching agents;

(5) The cellulose conversion products obtained by heating cellulose alone or in presence of water or glycerine or salts of any kind at normal or increased pressure;

(6) The cellulose conversion products (cellulose hydrates) produced by treating cellulose with alkali lye of various concentrations (mercerized cellulose), with or without subsequent washing, with or without subsequent treatment with a dilute acid and with or without previous or subsequent or simultaneous treatment with bleaching or oxidizing agents;

(7) The cellulose conversion products produced by treating cellulose with hot alkalies;

(8) The cellulose conversion products which are separated—and where necessary washed—by suitable precipitating agents or other means, from solutions of cellulose or cellulose hydrates, for example from solutions of cellulose or celluose hydrates or hydrocelluloses in ammoniacal cupric oxide or any other solvent containing copper as its basis; or from solutions of cellulose or cellulose hydrates or hydrocelluloses in zinc halides, for example zinc chloride alone or in presence of acids or other salts; or from solutions of cellulose or cellulose hydrates or hydrocelluloses in strong mineral acids, such as sulphuric acid, phosphoric acid, hydrochloric acid, arsenic acid and the like; or from solutions of cellulose xanthates (when decomposed spontaneously or by other means);

(9) Artificial threads of every description produced from cellulose or cellulose conversion products or cellulose derivatives, such as artificial silk, artificial silk waste, artificial cotton, staple fibre and the like;

(10) The cellulose conversion products obtained by treating cellulose or its conversion products with strong mineral acids, zinc chloride or ammoniacal cupric oxide, but short of dissolution;

(11) Hydrocellulose of every kind, such as is obtained, for example, by treating bleached or unbleached cellulose with dilute acids in the cold or at raised temperature under ordinary or increased pressure or by drying in presence of acids;

(12) Oxycellulose of every kind;

(13) The cellulose conversion products obtainable from cellulose derivatives such as esters or the like by scission of the molecule or by saphonification, such as, for example, denitrated cellulose nitrate or saponified cellulose acetate or formate or the like;

(14) Cellulose derivatives formed from cellulose by introduction of radicles by addition or substitution for the purpose of making the product soluble in aqueous alkalies. These include, for example, the alkali-soluble cellulose derivatives obtained by treating cellulose or cellulose conversion products with alkylating agents (see for example U. S. Patent No. 1,589,606).

The conduct of the process is simple. It consists essentially in treating the parent material, while stirring, until dissolution occurs. with an aqueous alkali solution containing an ammonia derivative of carbon dioxide or of a sulphur derivative of carbon dioxide, or mixtures of such substances as are able to form an ammonia derivative of carbon dioxide or of a sulphur derivative of carbon dioxide, or substances capable of being decomposed with formation of ammonia derivatives of carbon dioxide or of a sulphur derivative of carbon dioxide. This treatment may be conducted either by dissolving the derivative of the carbon dioxide or sulphur derivative of carbon dioxide in the alkali solution and introducing the parent material into this solution, or even by mixing the parent material with the alkali solution and only then adding the carbon dioxide derivative.

If dissolution is accomplished while cooling, it is preferably effected in a vessel adapted to be cooled either externally or internally or both externally and internally and having in addition, a mixing, kneading or stirring device.

Strength of Solutions

With regard to the strength of the alkali solution, it has been found that in presence of the carbon dioxide derivatives in question, caustic soda lye even of 2 per cent strength and up to 16 per cent strength has a dissolving effect. According to the present state of the process alkali lyes corresponding, say, with a caustic soda lye of less than 15 per cent strength, for example caustic soda lye, of from 4-12 per cent strength, may be indicated as preferable.

As to the proportion to be used of the derivatives of carbon dioxide or of sulphur derivatives of carbon dioxide, satisfactory results are obtained even with very small proportions, for example from 2-10 per cent of the weight of the parent material. Much larger proportions may, however, be used, for example an amount equal in weight to that of the parent material or more.

The solutions obtained according to the present process, if necessary after previous filtering or straining or centrifuging, may be used for the manufacture of technical products, such as artificial threads and yarns (for example artificial silk, artificial cotton, staple fibre and the like), artificial hair, films of every kind, plastic masses, coatings of every kind on paper, textiles, leather and the like, dressings and fillings of fabrics, sizing of yarns, book cloth, artificial leather and the like.

The solutions are easily worked up into technical products, since they are readily coagulated by suitable precipitating baths, such as inorganic or organic acids, salts alcohols, in some cases even water, or by

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TRADE DOW MARK

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●●●

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DEPENDABLE
ACCURATE
COMPLETE
PLASTIC MOLDING
SERVICE

DIRECT YOUR INQUIRIES TO

Reynolds Spring Company

PLASTIC MOLDING DIVISION

JACKSON, MICHIGAN

●●●

BAKELITE

LUMARITH ALDUR

heat, steam and the like.

The following examples illustrate the invention the parts being by weight:—

I

(a) 12 parts of bleached cotton in the form 228 parts of caustic soda lye of 8-10 per cent strength at room temperature, preferably while stirring or kneading, to produce a homogeneous mass. If the parent material readily absorbs the caustic soda lye or is rapidly subdivided therein, the stirring operation may occupy only 10-15 minutes. The mixture may, however, so as to impregnate uniformly the medicated cotton wool with the lye. After the mass has become homogeneous, 10-20 parts by weight of thiourea, preferably previously pulverized, are added and the whole is thoroughly stirred. The mixture is then cooled in a vessel having an external or internal or both an external and internal cooling device and adapted to reduce the temperature to that desired (for example the vessel may be surrounded by a freezing mixture at about—15° C. to —25° C., or by a double jacket which can be cooled with or without cooled mixing blades or a cooling worm or the like) and during this operation the mass is stirred, kneaded, shaken or otherwise agitated. When the temperature of the mass has fallen to —9° C. to —11° C. which starting from the beginning of the cooling operation occurs in about 10-20 minutes, it is slightly frozen and resembles a milky lard in consistence and appearance. Cooling is now interrupted to room temperature. This may be done, while stirring, either at room temperature or, in order to accelerate the process, while gently heating. As soon as the temperature of the mass has risen to room temperature, there is present a solution practically free from crystals and undissolved constituents; should it still contain any it may be freed therefrom by filtering or straining. Spread on a glass plate and treated with dilute

sulphuric acid (for example of 10-20 per cent strength) the solution yields a clear, firm film.

(b) The mode of operation is as in (a), with the difference that the mass is kept for 10-12 minutes at —10° C. to —11° C.

(c) The mode of operation is as in (a) or (b), with the difference that the thiourea is dissolved in the caustic soda lye before the introduction of the medicated cotton wool.

II

Into 480-600 parts of a solution of guanidine of 10-30 per cent strength in caustic soda lye of 8-10 per cent strength, 20 parts by weight of finely subdivided cellulose, for example sulphite-cellulose, are introduced and the mixture is stirred for a considerable time at room temperature. Thereupon is produced a very viscous solution, in which a moderate quantity of undissolved fibres is distributed. The mixture or the not-quite-complete solution is now cooled as in I (a) or (b), while stirring, whereby there is produced a practically perfect solution which, if necessary, may be freed from any undissolved constituents by straining or filtering or centrifuging.

Spread on a glass plate and treated with a suitable precipitating bath, for example dilute sulphuric acid, the solution yields a transparent film.

The second patent, U. S. P. 1,771,460, is quite similar, but the claims are particularly directed toward the use of guanidine. If cellulose that has been partially depolymerized by the action of sulphuric acid, or is derived from viscose, is treated with a cold aqueous solution of guanidine or tetramethylammonium hydroxide or tetraethylammonium hydroxide. The solution is cooled to —8° C. to —11° C. and kept at that temperature for some seconds up to 30 minutes. Viscous solutions result. These, when spread on glass plates, etc. and treated with a percipitant such as sulphuric acid, yield flexible transparent sheets.

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NEWS *of the* INDUSTRY

Synthetic Phenolic Resin Products Barred from Import

A proclamation issued December 1 by President Hoover forbids the importation of certain articles of synthetic phenolic resin and marks the final step in a bitterly fought legal battle which went twice to the Supreme Court of the United States. The proclamation, promulgated by the Bureau of Customs, forbids the importation of synthetic phenolic resin of Form C or articles made from it (except those made by molding synthetic phenolic resin mixed with other materials) when composed of different colored sections joined by applying a fusible phenolic condensation product, as described in U. S. Patent 1,424,738. The order also forbids entry of all articles of synthetic phenolic resin of Form C "unless clearly and unmistakably shown by means of a distinguishing mark, name, inscription, or label, placed upon the articles or attached thereto, that such articles are not made from synthetic phenolic resin of Form C manufactured by the Bakelite Corp., or unless said articles are otherwise reasonably distinguished so as to prevent confusion between the imported and the domestic articles on the part of the purchasing public."

These articles have been forbidden importation since April, 1926, under a temporary order issued by President Coolidge, but large quantities have been entered under bond and must now be exported or the bonds forfeited.

Quigley Addresses A. S. M. E. Section in Worcester

LEON V. Quigley, Technical Editor of the Bakelite Corporation, New York, delivered an illustrated lecture on "Engineering Factors Underlying the Replacement of Metals by Synthetic Plastics" before the monthly meeting of the Worcester section, of the American Society of Mechanical Engineers, at the Aurora Hotel, Worcester, Massachusetts, Thursday, January 15th.

Moore on Tour With Varnish Resin Talk

ROBERT J. Moore, Manager of Varnish Resin Development Department, Bakelite Corporation, Bloomfield, New Jersey, was scheduled to deliver the following talks:

January 15—"New Developments in Paint and Varnish", Cleveland and Buffalo Paint and Varnish Production Club, at the Chamber of Commerce Club in Cleveland, Ohio.

January 16—"Synthetic Resins and the Varnish Industry", Akron Section of the American Chemical Society, Akron, Ohio.

January 23—"The Changing Varnish Industry", Chicago Section of the American Chemical Society, at the City Club, Chicago, Illinois.

January 27—"New Developments in the Varnish Industry", St. Louis Paint and Varnish Production Club, St. Louis, Missouri.

Hercules Powder Laboratories Near Completion

NEW experimental laboratories costing more than half a million dollars, which will house the research facilities of the Hercules Powder Company here, are nearing completion. The main laboratory building and a number of smaller units have been finished and are awaiting installation of equipment.

The new location near Wilmington represents a closer contact of the company's research department and its main office, the laboratories being moved here from Kenvil, N. J. The new research laboratories will be formally opened within the next few months, it is stated by the company's officials.

Much of the Hercules company's growth has been founded on the results of chemical research, states Russell H. Dunham, president of the company. The principal products of the company, nitrocellulose, cotton linter pulp, naval stores, and explosives, have all been developed for more wide-spread industrial use through research activity, and, according to Mr. Dunham's statement, continuation of this activity is planned to insure future growth.

Simplified Practice on Abrasive Grain Sizes Now in Effect

THE division of simplified practice of the Bureau of Standards, recently announced that the simplified practice recommendation covering allowable limits for the sizing of aluminum oxide and silicon carbide abrasives for polishing uses and grinding wheel manufacture has been approved by the industry for publication as an effective program.

It is expected by those in the industry that the adoption of this recommendation will stimulate similar study of other kinds of abrasive grains and subsequent formulation of additional simplified practice recommendations in this field.

Revision of "Sawdust and Wood Flour"

THE amount of wood flour consumed in the United States is increasing steadily, indicating that this material is becoming an important factor in many of our industries. Information relative to it is now being gathered through questionnaires which will later be supplemented by field work. When the necessary data have been gathered, they will be compiled and incorporated in a revised edition of the National Committee on Wood Utilization bulletin "Sawdust and Wood Flour".

Trickey Makes Change

DR. John P. Trickey, until recently with the Simmons Co. in charge of plastics and resinoid development, has joined the research staff of the Carbide and Carbon Chemicals Corp., Charleston, W. Va.

New Equipment

Economy Lifting Machines

THE Economy Engineering Company, 2653 West Van Buren Street, Chicago, is about to announce an entirely new line of Ball-bearing equipped lifting machines. Both hand and power operated, plain and telescoping machines are included in the new development.

Ball-bearings, in these new models, are used throughout the gearing and in the sheave and platform frame wheels. On the Telescopers the sliding frame wheels are also equipped. Friction is further reduced through recently designed flangeless guide wheels which are used to support the platform and telescoping frames.

CONSOLIDATED Products Corp., 15 Park Row, New York City, have available their latest bulletin No. 31 which is said to contain the largest assortment of overhauled and rebuilt machinery for the chemical and process industries.

Howe Weightograph

THE Howe Scale Company of Rutland, Vermont, has issued an interesting booklet covering their Weightograph. The Weightograph, which is claimed as the most modern automatic indicating instrument, can be attached to any type of beam operated scale from dormant warehouse to railroad track scale. When so attached converts the beam to an automatic scale. This is accomplished without disturbing scale or discarding anything but one beam stand which is replaced by the Weightograph.

The Weightograph is the only electrical illuminated indicating device on the market; and employs the principle of optical magnification for projecting the operation of the scale instead of mechanical multiplication as in other automatic indicating devices. Many prominent and extensive users the county over are claimed for the Weightograph.

Travis Colloid Mill

A NEW model laboratory and production mill is offered by the Diamant Tool and Mfg. Co., Inc., Newark, N. J., which has a capacity for emulsions and dispersions at the rate of 20 to 60 gallons per hour. Working parts resist acids and alkalies. In addition to the hydraulic shearing action, a turbulant dispersing action is produced by eddy currents between the revolving surfaces.

Chemists' Club In New York Makes Extensive Alterations

Rumford Lecture Hall Converted into a Comfortable Lounge.

INCREASED membership of the Chemists' Club in New York City called for larger and more modern quarters. Accordingly, with monies recently appropriated, renovation and improvement has been made possible on four floors. What was once the lounge and dining-room floor, is now devoted entirely to the service of meals, a special main dining-room having been provided, and a separate pavilion in which lady guests of the members may be entertained. The estwhile billiard-room, on the library floor, has given way to a more complete library. The gaming instincts are accommodated by renovation of the basement area. A commodious billiard-room, also card-rooms have been installed. The new club lounge, shown here, has involved a transition almost alchemical. While it is still Rumford Hall in name and association, the barren interior has been converted through new decoration and furnishing. Some will recognize space where once was the stage from which medallists spoke and now in its place there is a fireplace with comfortable conference corners offset by walnut wainscoting. Details of the beautiful ceiling long since forgotten because of dust and faded paint, are now brought out in their true beauty. Ceiling panels in cerulean blue are particularly restful. In the dining-room, also, the familiar chemical hexagonal ceiling treatment has been retained. Dr. L. V. Redman, Director of Research of the Bakelite Corp., is president of the Chemists' Club for 1931.

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Presses—Polishing (Hydraulic)

Rolls—Converting

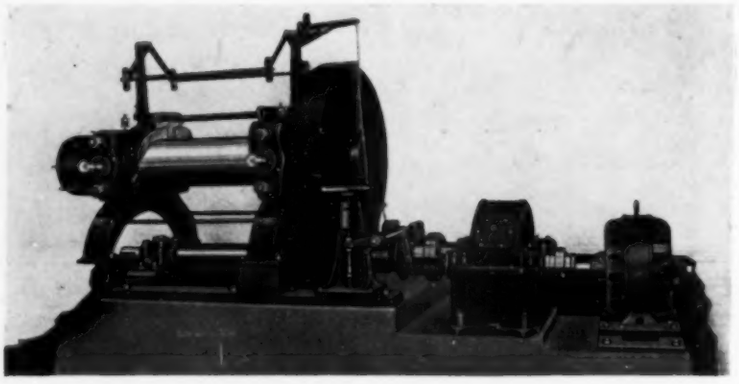
Rolls—Mixing

Rolls—Sheeting

Safety Clutches for Rolls

Sheet Cutters or Planers—Hydraulic

Speed Reduction Units—Farrel-Sykes



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The coil clutch provides for quick stopping in case of emergency as well as for service operation. The motor drive is the enclosed type with Farrel-Sykes, continuous tooth, double helical reduction gears, built-in bearings and automatic lubrication for both gears and bearings. The drive and shafting are arranged for the addition of another Mill later to make a unit of two driven by the same motor.

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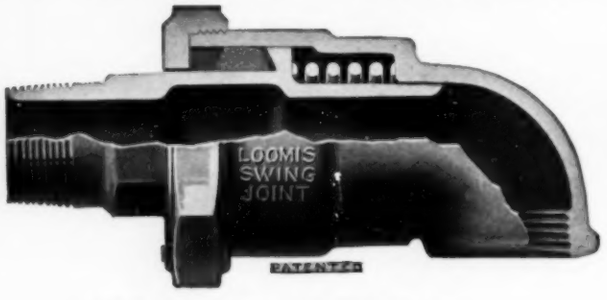

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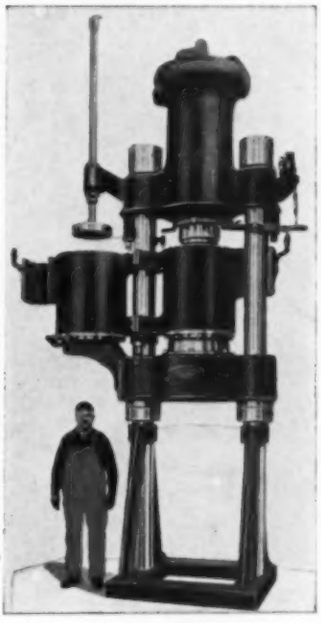

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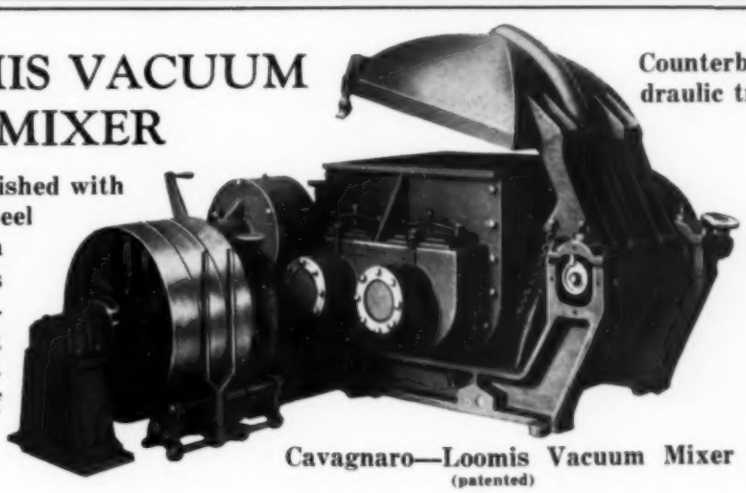

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Sliding Platen Press Simplifies Molding

Tilting head and platen that slides in and out of the press enhances facility of operation

A HYDRAULIC press that has a tilting head and whose platen also slides forward, so as to afford better access thereto by the operator, has been invented by Leslie S. Hubbert, of Edison, Ohio, and its manufacture taken up by the Hydraulic Press Manufacturing Co., of Mount Gilead, Ohio. The press, of course, is patented. It has many interesting features, which can only be understood by a detailed description. Perhaps the very best way to describe any new machine is to adopt verbatim the language used by the inventor. Quotating from the patent (U. S. P. 1,778,803) covering the new press, and referring to the two illustrations herewith, the invention relates to improvements in the type of press disclosed in Patent No. 1,567,766, granted December 29, 1925, to T. F. Stacy, and particularly relates to an improved mechanism for tilting the upper press head and for giving the lower press table a sliding movement into and out of its operative position. These two movements are to bring the head and table into a position more accessible to the operator.

Constant Pressure on Cylinders

The mechanism for producing both of these desired movements comprises double acting hydraulic cylinders of the differential type, and hydraulic piping is connected to each so that a constant pressure is exerted against the small end of the rams which slide in the cylinders. Means is provided whereby these members can be moved out of the pressing position by means of pressure admitted through an automatic valve to the large end of each cylinder.

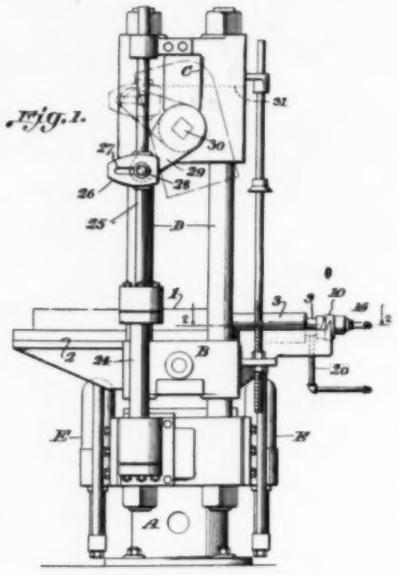

Figure 1 is a side elevation of the press, including the present invention.

Figure 2 is a horizontal section taken on the line 2—2 of Figure 1.

In many respects, the type of press to which the invention is applicable may be widely varied, but there is shown herein a press having a base A supporting the platen B, which is movable upward to bring the dies carried thereby in contact with an upper press member supported by the head C of the press. The upper and lower members of the press frame are preferably connected by four strain rods D. There may also be provided pullback or stripping cylinders E which return the platen B to its lowermost position. These parts are or may be substantially similar to those shown above.

The lower press member comprises a table 1 which is adapted to slide on guideways 2 carried by the vertically movable platen B. This table has a cylinder 3 formed integral therewith, the cylinder opening projecting through the table and being lined with a tubular member 4. Opposed ends of the cylinder are closed by packings 6 and 8 respectively held in place by gland nuts 5 and 7. It will be noted that the platen B is also a support upon which the table 1 is carried.

A hollow piston rod 9 is held in a supporting member 10 carried by the press frame and has lock nuts 11 and 12 screw threaded thereon on each side of the member 10. This hollow piston rod passes through an opening in the gland 5, and at its inner end is screw threaded at 13 into a piston head 14 provided with suitable packing 15 between the outside thereof and the wall of the hollow piston rod 4. A pipe 16 passes concentrically through the piston rod to form a resultant space between the piston rod and the pipe, and suitable compression packing 17 is provided around the pipe at its outer end. At its inner end the pipe 16 is screw threaded into the piston head 14 and the pipe connects with a passageway 18 through said piston head, which opens into a chamber 19 at the inner end of the cylinder 4. A pipe 20 passes through the wall of the piston rod 19 outside of the cylinder 4 and permits fluid under pressure to flow into the space within said piston rod surrounding the pipe 16. Near the inner end the piston rod is provided with an opening 21 which communicates

with the chamber of the cylinder 4 on the outside of the piston rod 9.

In the position shown in Figure 2, the table is in its inner or operative position, and if it is desired to slide the table to the outer position, where it will be accessible to the operator, fluid under pressure will be admitted to the pipe 16 and passage 18 into the chamber 19. Since the piston rod 9 and piston 14 are held against endwise movement, the pressure of the fluid will cause the table to move toward the left of Figure 2 to its outer position. When the table is moved back into the inner position, pressure will be released from the chamber 19 and fluid under pressure admitted through the pipe 20 and opening 21 into the space surrounding the piston rod 9, and will exert its pressure against the head 23 at this end of the cylinder, which, it is to be noted, is approximately one half the area of the head formed by the chamber 19. The table will therefore be returned to its inner or operative position. Due to the fact that the piston rod passes through one end of the cylinder the effective area of that end is less than that of the other so that pressure may be constantly contained in the pipe 20, since, when pressure is admitted to the pipe 16, it will act against a head substantially twice as great as that of the other head, so that the table may be moved outwardly, notwithstanding the fact that the fluid under pressure entering through the pipe 20 tends to return the pipe to its inner position. It is to be noted that while the table 1 is normally disposed between the platen and the press head C, it is adapted to be moved laterally toward the front of the press to a projected position. The means for thus moving the table are connected to the support upon which the table slides, at the rear end only of the press so that said means do not in any way interfere with the operator who stands at the front of the machine.

The present invention also comprises a different means for operating the upper tilting platen or press head. A double acting cylinder 24 is provided with a piston rod 25, which carries intermediate its ends a member 26 having a slot 27 therein. A pin 28 works in this slot and is carried by a crank arm 29 which is fastened to the trunnion 30 of the tilting platen head. It is obvious that a right line movement of the piston rod 25 will result in rotating the platen head 31 through the desired angle, which is preferably about ninety degrees.

It is obvious that any desired form of stops may be employed to limit the movements of the table and the tilting head in each direction. Both the table and the tilting head are formed with T-slots in the usual manner for the attachment of dies, and they may be equipped with any desired form of knockout devices. The sliding table may be equipped with adjustable gibs for taking up lost motion or wear. The movable platen which carries the table and the main ram are returned to lower position by gravity, assisted by the auxiliary hydraulic cylinders E.

Although not strictly a portion of the present invention, it may be noted that the present press is automatically controlled by a motor-driven valve which causes the following operations to take place in sequence during one complete revolution of a motor-driven cam shaft.

1. The press head and sliding table are moved into pressing position, since at this time the large end at each differential auxiliary ram is connected to the exhaust, thus allowing the pressure to act on the opposite or small end of the rams.

2. The valve thereupon stops and after a final inspection the operator trips the automatic lever and the cycle proceeds automatically.

3. Steam is admitted to the chambers of the dies.

4. The dies are closed and the main ram moved upwardly under low hydraulic pressure.

5. High hydraulic pressure is applied to the system.

6. Steam is cut off and cold water circulated through the die chambers. Both the steam exhaust and the water connections are operated through the automatic valve.

7. Hydraulic pressure is applied to the auxiliary cylinders, which return the main ram and platen.

9. During the opening of the press, hydraulic pressure is applied to revolve the head and slide the table out of pressing position so that the operator may quickly remove the finishing pieces, clean the die cavities,

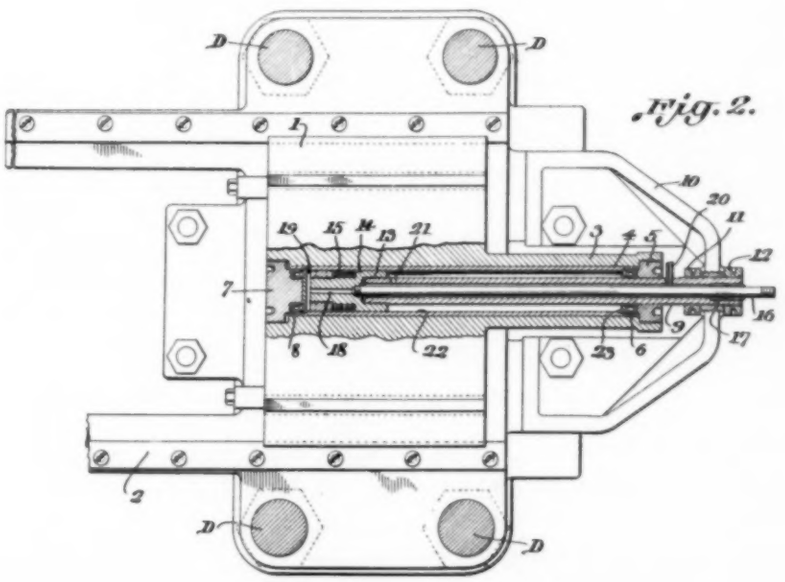

Fig. 2.

and place inserts and raw molding materials for the starting of the next operation. In each case the operation is initiated by tripping a lever which closes an electrical circuit and starts the valve motor. The duration of the entire cycle is regulated by proper gearing provided for the motor shaft and the valve operating cam shaft.

Molded Mica Products

(*Continued from page 77*)

ing a varnish. The varnish is now applied to the mica flakes according to one of two alternative methods which are illustrated in the accompanying Figures 1-4. A desired area of a hot plate may be covered with overlapping flakes of mica and the varnish applied by spraying, pouring or brushing on to the surface of the flakes. The varnish flows in all directions and thus binds the flakes together. The heat of the hot plate drives off the volatile solvent employed and partially hardens the phenol-urea-formaldehyde products. A sheet is then produced such as illustrated in Figure 1 where the overlapping mica sheets a are bound together by a layer of condensation product b. Further flakes can be added to this layer and the process repeated until a sheet of desired thickness is obtained. Two such layers are represented in Figure 3. Alternatively the mica flakes or sheets may be coated with the varnish or solution of condensation product by immersing them in the varnish and then heating them on a hot plate sufficiently long to drive off the volatile substances employed and to partially harden the phenol-urea-formaldehyde products. A sheet then will be obtained such as that illustrated in Figure 2 where the condensation product b completely surrounds the mica sheets a and as in the former case further flakes can be added to this layer and the process repeated until a

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sheet of desired thickness is obtained. Two such layers are illustrated in Figure 4. The sheets thus obtained by either of these methods can readily be handled and stacked together without sticking and may thus be stored until required for any specific purpose when they can be cut into the desired shape or length.

Square and round tubes are made of this bonded mica by rolling a length of sheet over a hot plate on a former in the manner usually employed and while still on the former the whole is stoved from room temperature up to about 300° F. (say 150° C.) taking altogether about three hours for the stoving and maintaining the articles at this latter temperature for the last two hours.

Sheets or plates or tubes of mica made in the manner hereinbefore described do not break up or flake when stoved and there is complete adhesion between the mica and the binder. Articles thus made are chemically resistant, mechanically strong and have good insulating properties and electrically they have volume and surface resistivity which is as good as mica bonded with shellac. The binder will not soften at any temperature and is no longer soluble in the usual solvents or oils. It does not char until heated to 310° C. When subjected to the heat of a carbon arc charring does not spread beyond the area under the arc.

Sheets or tubes built up with this binder find valuable use in the electrical industry, for example, as end shrouds for commutators, etc. This phenol-urea-formaldehyde product does not exhibit the same tendency to "track", the phenomenon usually associated with phenol-formaldehyde resins.

Articles built up in the manner hereinbefore described can be immersed in boiling water for several minutes without softening and by prolonged stoving they can be made completely resistant against prolonged immersion.

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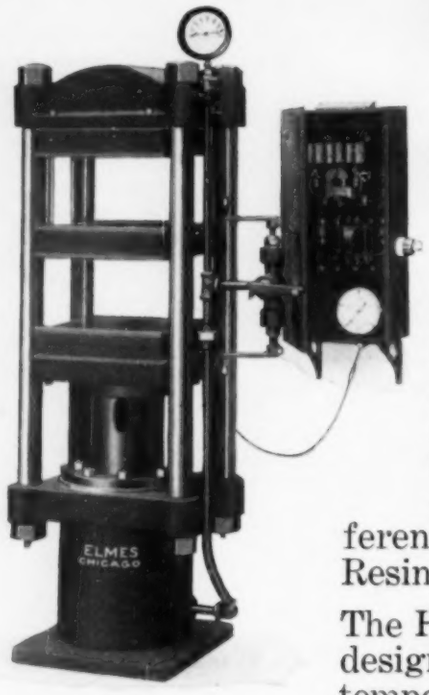

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Odorless Phenolic Resin Varnishes to Produce Laminated Sheets for Refrigerators

By Arthur J. Norton[1]
General Plastics, Inc.

CHANGES in the materials employed in construction work have been most remarkable during the past ten years. Lighter, stronger, and more durable products are being used in all types of work. The phenolic resins and their molding compounds have played a tremendous part in this change, giving not only stronger and more lustrous products but allowing materials to be made with high electrical properties and with a permanent finish, which is difficult to duplicate by the use of paints and varnishes.

At first this work was confined to small pieces molded under heat and pressure, but with the development of a laminating process, by which large panels of this material can be made, the uses have expanded into building and furniture trades. During the past year the use of laminated stock for hotel paneling, desk tops, radio panels, window decoration, and similar work has been quite common and on the increase. Refrigerator manufacturers have been particularly anxious, and have been working for the last three or four years to obtain a product of this type because of the desirable qualities of laminated board. The use of these materials, however, was limited, as they were not satisfactory when brought into close proximity to foodstuffs, because of the slight residual traces of phenol odor which were readily absorbed by almost any type of fatty product, such as butter.

The new odorless Durez varnish of General Plastics, Inc., has contributed to the solution of this problem and the use of laminated board is now possible for manufacturers of refrigerators and work of similar nature. This varnish is made to a definite viscosity which is sufficiently high to insure uniform coverage, and yet low enough to guarantee thorough penetration. The viscosity range is held within very close limits, as is the available resin content. The laminators can thus be assured of a uniform consistently working product.

Filler sheets are impregnated after the usual manner, dipping the paper in the varnish and heat-treating it to dry off the solvent and advance the resin to a point where it can be molded to best advantage. The heat treatment is generally done at about 250° F., either in a tower or a continuous tunnel operation. The treated paper, when pressed under standard conditions, should have the resin so far advanced that less than 1 per cent of it will squeeze out during the pressing operation.

[1]From News Edition of Industrial and Engineering Chemistry.

Resinoid Printing Plates

By Charles W. Rivise

COMPLETING the article from p. 53 of the January issue we find the following:

E. R. Torrison, 1,681,447, Aug. 21, 1928. Filed Aug. 26, 1926.

Matrix and Method of Making Same

The method consists in applying a mask to the face of a type forming body, said mask having a cut out portion to expose selected portions of said type, applying a coating of sprayed metal to the exposed portions, removing the mask and by the means of heat and pressure uniting a resinoid composition either in the form of a powder or laminated material to the metallic face to form a backing therefor. The type forming body is then removed. A variation consists in omitting the mask.

Wm. M. Kelly, 1,707,729, April 2, 1929. Filed Dec. 27, 1926.

Matrix Plate and Method of Making Printing Plate

The method consists in applying make-ready to an original (photo-engraving, line plate, half-tone plate, electrotype or stereotype), placing a re-enforced soft metal sheet against the face of the made-ready plate and taking an impression in relief by pressure, placing a phenolic resinoid on the face of said metal plate and subjecting the two to heat and pressure. The resinoid is preferably provided with a wire mesh or canvas re-enforcement. Curved plates may be made.

E. S. Hole, 1,726,151, Aug. 27, 1929.

Method of Making Printing Plates and Matrices

See Australian Patent 7979/1927.

M. C. Beebe, H. V. Herlinger and R. Swain, 1,740,061, Dec. 17, 1929. Orig. Filed Jan. 2, 1925.

Method of Making Lithographic Plate

The method consists in applying an ink transfer to a metal plate, applying a protective coating, washing off the ink transfer with a suitable solvent, applying resinoid lacquer which is insoluble but still reactive, heating the plate to convert the resinoid to the final stage and finally removing the coating on the unexposed portions. See also Patent 1,587,269.

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Molded Telephone Parts

(*Continued from page 76*)

most of which are used to replace the shellac-composition mouthpieces now in service. The phenol-plastic mouthpiece is manufactured at a cost slightly higher than that of shellac-composition mouthpiece, but owing to its superior physical strength and freedom from breakage in service, its use is an economy to the Bell System.

The molding of the subscriber's set housing illustrated in Fig. 1 has certain features of interest. Duo-presses of 350-ton capacity are used for the production of this part, an 8-cavity mold being used.

It will be noted that this molded part contains, in addition to the two screw holes which are produced in the molded box by pins set into the mold, a series of slots in both sides and in one end of the box which are molded by details which are automatically withdrawn on opening the press. The molded boxes are raised slightly to permit easy withdrawal from the mold by means of pins in the ejecting fixture which is elevated against the bottom of the mold by the subpress ram. These ejecting pins lift the box by pushing upward on the pins which form the screw hole in the box. The production of these boxes by molding is a good example of the advantages of plastic molded parts where good finish and mechanical properties are desired in the finished part with a minimum number of operations. The box is practically finished when it is taken from the mold and requires only the removal of the flash from the edges by means of a surface grinder, and from the slots by a punching operation.

Another interesting molded part which, for its size, probably holds the record for number of inserts, is the test strip. This part contains 200 brass pins uniformly spaced parallel to each other. It is 7¾ in. long by 1 in. wide and is molded from four preforms composed of a very soft grade of phenol-plas-

tic compound. The molding pressure is applied parallel to the pins by a plunger which contains a hole for each pin to recede into as the mold closes.

Manufacture of Hard-Rubber Molded Parts

The manufacturing methods used on high-production hard-rubber parts are of interest, and good examples are the receiver shell and cap used on the desk-stand telephone. The shell is molded from rubber compound and the cap from hard-rubber dust which is made from scrap hard rubber ground to about 50 mesh. The molding of the cap represents a transition in plastic-molding practice between phenol-plastic molding and rubber-compound molding and will, therefore, be described first. These caps are molded with a square-edged rim, in multiple-cavity hand molds. The body of the mold is steel and has a cavity lined with brass. The upper and lower halves of the cavity are formed by two cylindrical details made from a "duralumin" type aluminum alloy which has proved satisfactorily resistant to the corrosive action of the sulphur in the rubber dust. A measured charge of dust is placed in each cavity in the mold, and the mold is then closed in a gas-heated press. The part is cured for 20 min. at a temperature of about 400 deg. fahr. under a pressure of about 2000 lb. per sq. in., after which the mold is transferred by hand to a cooling press which is a duplicate in construction of the heating press. When the mold is cool the parts are ejected and the threaded detail is unscrewed by means of a motor-driven fixture.

The desk-stand telephone receiver shell is a good example of rubber-compound molding in which a plastic rubber compound is molded to shape and hardened by vulcanizing. The unvulcanized rubber compound is prepared in sheets about ¼in. thick from which are blanked the irregularly shaped pieces shown in Fig. 6, two of which are used for each receiver shell.

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As the vulcanizing time in the production of hard-rubber parts such as this one is a matter of hours, the use of molding presses is impractical, as the relatively small capacity of the press and the long curing time would necessitate an excessive investment in equipment. These parts are, therefore, molded in aluminum-alloy molds, a number of which are stacked on steel trucks and blocked with steel wedges to maintain the pressure on them. These trucks are then placed in large steam vulcanizers and the parts are vulcanized under steam pressure at a temperature of about 300 deg. fahr. for half an hour.

Manufacture of Shellac Molded Parts

Plastic molding compositions containing shellac as the principal resinous binding agent have been in use for many years, and despite considerable experimental work with other resins as shellac substitutes, shellac is still widely used in the better grade of thermo-plastic molding compositions. The shellac compositions used in Bell System parts contain 20 to 50 per cent of shellac with the remainder principally 100-mesh ground mica or wood flour.

The principal shellac-composition part now used by the Bell System is known as a panel dial-system commutator, one type of which is shown with the flash type mold used in its production, in Fig. 7. This part is a molded bar containing a number of brass contact strips and because of the number and location of these strips, the production of this part is interesting from a manufacturing standpoint. The compound is softened on a steam plate and laid into the bottom half of the mold in a plastic strip. The brass strips, which have previously been laid into their respective grooves in the mold, are held in place in the upper half of the mold by two long pins inserted in holes in the lugs shown. The two halves of the mold are laid together, the holding pins are withdrawn, and the mold is placed between the platens of a press and closed. This part is finished by grinding and polishing the surface until the molded surface and the brass inserts are uniformly smooth.

Properties of Plastic Molding Compounds

Plastic molding compounds of the three classes described, phenol plastic, shellac composition, and hard rubber, are used for the manufacture of the parts described for various reasons which involve the design of the part and its use.

Phenol plastic is used where hardness, resistance to abrasion in handling, good electrical characteristics, good finish, high physical strength, and permanence are desired. A major reason for its use in quantity production of irregularly shaped parts, such as the hand-set handle containing numerous accurately located inserts, is the comparatively low cost at which parts of this kind can be produced. A few moments' consideration of other possible materials and methods of manufacture of such a part as the hand-set telephone handle will show that the

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manufacture of such a part by any other process would be considerably more difficult. The same reasons justify, in varying degrees, the use of phenol plastic for numerous other parts.

Shellac compositions are used where the requirements for appearance, resistance to softening at elevated temperatures, resistance to corrosion and discoloration in handling are less severe. They are, in general, lower in cost than phenol-plastic parts and where the electrical and mechanical properties required are such as to permit their use, they are quite satisfactory. For certain parts such as the commutator, already described, a shellac-mica compound is superior in resistance to mechanical wear than other plastics, with the possible exception of certain grades of hard rubber.

Hard-rubber parts are used where good mechanical strength especially in resistance to impact, is desired. They are not entirely satisfactory where high electrical surface resistivity is important as they deteriorate in this respect in the presence of sunlight and moisture. Surface discoloration on aging is also an objection to the use of hard rubber where appearance is important and the cold flow of hard-rubber parts, if subjected to permanent loads, is also objectionable under certain conditions.

Of the three types of plastic compounds discussed, the predominant plastic of the future as regards quantity consumed will probably be the phenol-plastic type, as it clearly possesses more of the properties desired in a plastic compound for general use than any other single compound now available. At current prices of phenol plastic and with modern molding methods, parts molded from these compounds can be produced at costs which make them active competitors of stamped and cast metal parts, and the future will, no doubt, see an even greater use of this valuable and adaptable product than now exists.

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Alginic Acid Plastics Interest Inventors

Instead of in its pure state, new compounds are described in which hydrocarbons form a part

ALTHOUGH alginic acid was discovered and prepared for a short time commercially as far back as 1883 by Stanford, in England, it was not until about six years ago that its commercial manufacture in the United States made available a supply that serves as a potential raw material for the impregnation and water proofing of fabrics, as an emulsifying agent, and for the manufacture of plastics.

We have from time to time called our readers' attention to the possibilities of alginic acid for plastic purposes (see the article by M. Deschiens in September, 1930, PLASTICS), and we feel certain that some of the latest developments in the application of this marine product wil be of interest to our readers. While in the past most of the plastic compositions employing alginic acid contained the same in the form of its soluble or insoluble salts, it now appears that alginic acid is sufficiently reactive to form a number of interesting compounds, some of which are applicable to molding compositions. It would appear as though alginic acid may some day form the starting point of many compounds such as perhaps esters and ethers, analogous, though by no means necessarily similar to, the corresponding cellulose and other carbohydrate compounds. Only as the correct formula for alginic acid is gradually worked out, however, can real progress along this line be expected.

The permanent beds of kelp on the Pacific coast will probably continue to furnish alginic acid compounds for ages. As the nature of the product is better understood, it will eventually form the basis for many interesting new compounds for use in the industrial arts.

Hydrocarbon Compounds of Alginic Acid

Products which are apparently compounds of alginic acid with hydrocarbons form the subject matter of the present article. They have been discovered by Laurie Lorne Burgess, of Cambridge, Mass.; who has obtained a patent both on the products as well as on the process of manufacture. The patent. U. S. P. 1,782,887; Nov. 25, 1930. is assigned to Plastic, Inc., of Keene, N. H. According to this invention alginic acid, or compositions containing the same, dissolved in an alkaline reagent, such as ammonium hydrate or soda ash or sodium hydroxide, etc., with hydrocarbon dissolved in a suitable solvent, such, for example, as carbon tetrachloride. During the heating it is best, but not essential, to agitate the charge during the reaction period. After the interaction of the constituents, precipitation may be effected therein by adding a mineral acid, such as hydrochloric or sulphuric acid, after which the precipitate may be filtered, washed and dried. This dried precipitate may be then extracted with carbon tetrachloride, thus separating the material into two portions, that is to say, the portion which dissolves in carbon tetrachloride and the residue. The residue is a dark colored substance which may be plasticized by the addition of ammonium hydrate and a suitable oxide so as to become insolubilized thereby, for example, by the addition of lime or zinc oxide or cupric oxide, and then molded into any desired shape. The articles thus obtained will be found to have great resistance to water, and are very hard and tough.

When a finely divided metal, such as copper, zinc, etc., is added to the original mixture at the time of the reaction between the hydrocarbon and the alginic acid, the mass precipitates of its own accord after the reaction has proceeded for several hours. The resulting mass may then be filtered off, washed and dried, and then extracted with carbon tetrachloride. The residue obtained may then be plasticized by ammonium hydrate and molded into any desired form. The resultant product has good water resistance and is harder and tougher than the material obtained without the addition of the metal. However, the material obtained as a residue, by distilling off the carbon tetrachloride from the liquid extracted with the carbon tetrachloride, appears to be substantially the same as in the case of the material obtained as described above in the process in which no metal has been added.

Example 1

An alginic acid jelly is prepared by breaking down a sea growth containing alginic acid, as, for example, Laminaria, in the presence of an alkali, such, for example, as sodium hydroxide, soda ash. This may be accomplished by treating 10 kilo-

grams of Laminaria, which may or may not have been previously dried with 0.2 kilograms of soda ash in the presence of 15 liters of water. This action is allowed to continue for a period of 5 hours. The algulose which has not become dissolved may then be removed by decantation or otherwise. The liquid thus obtained is then precipitated by the addition of 400 cc. of a dilute mineral acid (N/1), such, for example, as hydrochloric acid or sulphuric acid. This produces as a precipitate, an alginic acid jelly containing in the jelly a considerable amount of water.

285 grams of the alginic acid jelly containing 15 grams of dry solid are dissolved in 10 cc. of concentrated ammonia and 200 cc. of water. 25 grams of paraffin wax and 50 cc. of carbon tetrachloride are then added, the paraffin having been previously dissolved in the carbon tetrachloride. The whole mass is then heated in a flask having a reflux condenser attached thereto. The flask is agitated for approximately 10 hours, while maintaining a temperature of 80 to 90° C. The contents are then precipitated by adding 60 cc. of a 10% solution of a hydrochloric acid, and the precipitate is filtered.

1. The process which comprises forming an insoluble product by the reaction of alginic acid upon a hydrocarbon and then plasticizing the product by the addition of an alkali.

17. A product comprising a reaction product of alginic acid and a hydrocarbon from which soluble constituents have been partly removed.

18. A product comprising a reaction product of alginic acid and paraffin wax from which soluble constituents have been partly removed.

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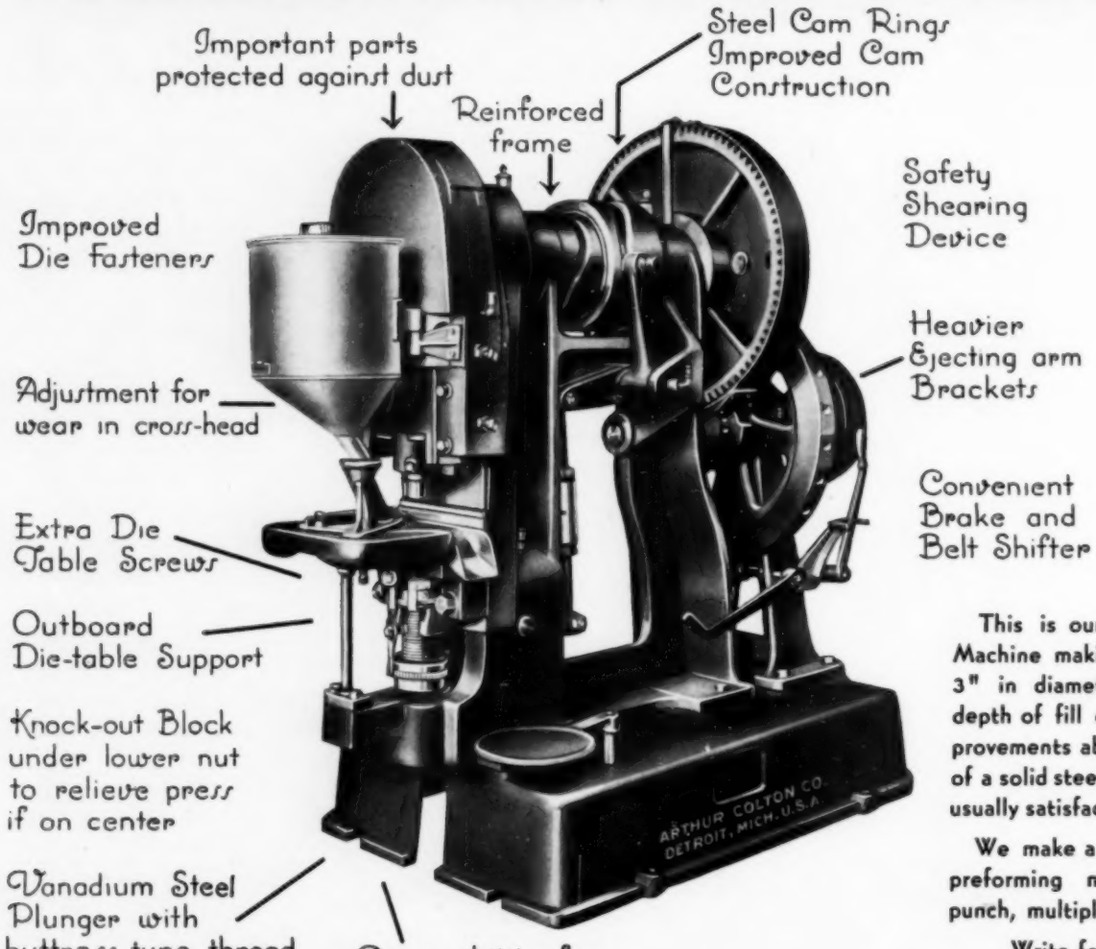
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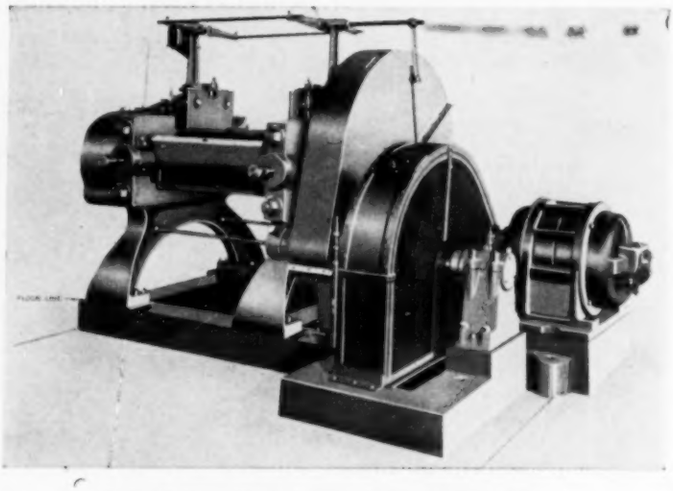

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"Colloid Chemistry"

A review of Jerome Alexander's new edition of his most interesting work

By Carl Marx
Editor, Plastics

THE present edition of Jerome Alexander's most excellently written work on Colloid Chemistry will be warmly welcomed by every chemist, and even the layman, who is interested in, or comes into contact with the raw materials, and products of nature as well as of man, that have colloidal properties.

To one not initiated into the (supposed) intricacies of colloid chemistry, it will be a revelation to find out how many of the processes of daily life, and such as take place in the manufacture of the commonest materials, are processes of colloid chemistry. To many readers the word "colloid chemistry" imparts nothing further than that the subject matter is connected with something too remote from daily life and too deeply submerged in scientific language to be comprehensible, and something to be relegated to the book-shelf with a shrug and the remark "too deep for me". Alexander, however, by his lucid style, has made this subject so interesting, and so readily comprehended, that any intelligent person can read his book both with interest, enjoyment and understanding. That, from the reviewer's standpoint, is, perhaps, its greatest charm.

Classification

The first six chapters, after a lucid introduction to the subject, deal with the definitions, illustrations and nature of colloidal dispersions, and their methods of preparation; followed by the classification of colloids, the use of the ultra-microscope, and the various analytical and manipulative methods employed in the determination of the properties of colloids in general. This covers a discussion of autoprotection, cumulative protection, dialysis, ultrafiltration, diffusion, electric charge and migration, pectization and peptization; viscosity and surface tension. As a little example of how so apparently a "deep" subject can be made vitally interesting, we reproduce a few lines from pp 25-26, in the section relating to the "zone of maximum colloidality".

"A most striking example of optimum dispersion is found in living matter. Figuratively speaking, if all chemical substances comprising our organism were in true or crystalloid dispersion, reactions would proceed so rapidly that we would, so to say, live ten years in ten minutes. On the other hand, if coarse dispersion prevailed, it would take ten years to live ten minutes. Every organism is dependent on the coordination of its reactions in *point of time*, and this leisurely procedure depends largely on *degree of dispersion*, which keeps chemical reaction velocities within certain speed limits through its regulation of free surface and kinetic activity. Life lies between lysis and coagulation. The colloidal zone is, as it were, a vital metronome tolling off the tempo of life". And they say science is "dry and dusty"! Well, not so when Alexander writes of it.

The Practical Side

To the layman, the balance of the book, beyond chapter six, is of particular interest, for it deals with the practical applications of colloid-chemical principles. A table, on p. 77 of the book, shows the extent to which these principles are applicable. They range from astronomy, meteorology, geology and gems, through agriculture, paints, pigments and varnishes, to photography, brewing, foods, ice-cream, chemical analysis and biology, and many, many more. Arranged into eight categories, each of these subjects is taken up, and the application of colloid chemistry thereto explained and elucidated. For instance, under the heading of astronomy we read that "it is but natural to expect to find many instances of colloid dispersion in the immensity of the Universe"; and "the zodiacal light also seems to be consequent on a cloud of colloidal matter generally believed to surround the sun. Lars Vegard recently advanced the view that the upper atmosphere contains minute crystals of frozen nitrogen, to which he attributes the blue color of the sky, as well as the green color of aurora borealis".

The Plastics Side

It would lead us too far afield to quote from each division of the book, so we shall confine ourselves to the parts of more particular interest to plastics and molded products. For example, on p. 117 begins the discussion of nitrocellulose and its products, Celluloid being described as a camphorgel (nitrocellulose dispersed in camphor). Its plasticity on heating to 80° C. is attributed to the fusion of the dispersing medium, camphor, which diminishes the internal friction. Paper and rubber are taken up in detail. Metals and alloys, such as steel, bronzes and the like, are all subject to colloidal phenomena, which help to explain the action of heat-treatment, hardening, embrittling and the like.

The chapters dealing on life-phenomena such as growth, are particularly interesting.

Now that almost every technical article employs the language of the colloid chemist, it is almost a necessity for the proper understanding of the same, that one acquire a fairly accur-

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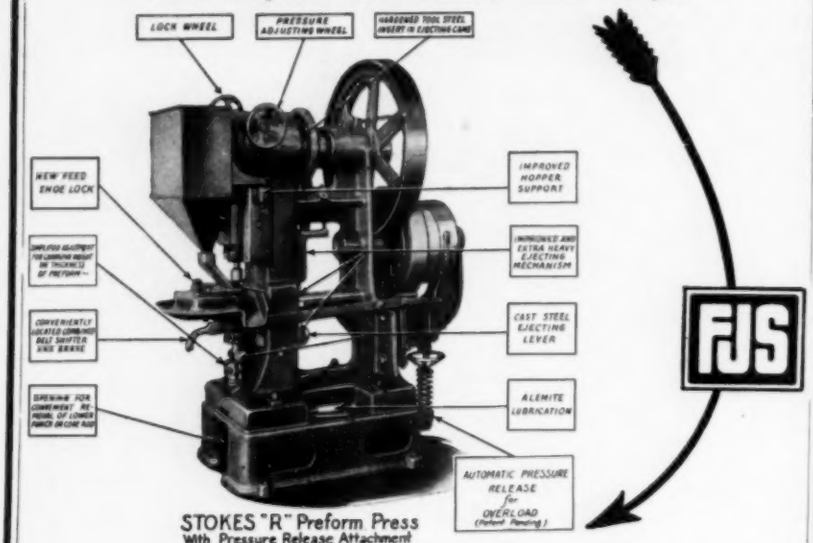

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ate knowledge of what the nomenclature used signifies. A reading of Alexander's "little book" (as he calls it), will do much to clear up the apparent density of expression found in many articles. A glossary is a welcome addition to the book.

The book is well equipped with both author and subject indexes, and printed and bound in the usual good style to which one looks when examining a book put out by this old and well-known publishing house. We warmly recommend the book to our many readers.

Plastic Trade Review

(*Continued from page 79*)

Laminated Phenolic Products Eight Companies

Billings 1927-1930
Gear and Non-Gear Stock

1927—$ 7,823,380
1928— 11,810,629
1929— 17,942,583
1930— 10,675,549 (est.)

In closing the body of this survey, special attention is directed to the detail charts which accompany it and which are based on our published figures for previous years and the collected statistics for 1930. There is a strong current of feeling within the industry that the coming six months will see a distinct change for the better, and this is, perhaps, not unreasonably based on the new prices and the new light-colored phenolic compounds that can be molded competitively with other types of material. Certainly it is sure that, when molders' sales advance, progress will be more pronounced in both powder and machinery and felt to some degree in the chemical industry.

Technical Abstract Section

A Concise Review of Patents and Literature

Rubberlike Composition. Effie H. Moss, of Chillicothe, O. U. S. P. 1,784,070; Dec. 9, 1930.

A rubber-like composition comprising linseed oil, lime, water, isinglass, soap solution, tincture of benzoin, grease, and mercury, in about the proportions of linseed oil two teaspoons: lime one teaspoon; water one and one-half ounces; isinglass one teaspoon; soap solution one teaspoon; tincture of benzoin five drops; grease one-quarter teaspoon, and mercury one drop.

Cork Board. William F. Grupe, assignor to Armstrong Cork Co., of Lancaster, Pa. U. S. P. 1,779,701; Oct. 28, 1930.

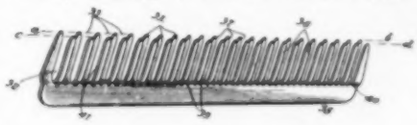
The method of forming corkboard which comprises severing natural cork including "hard-back" or "belly" portions transversely to the length of the bank to form strips having lengths relatively much greater than their thickness, subdividing such strips into plates while substantially preserving the dimension of thickness of the same, the dimensions of length and breadth of said plates individually being materially greater than the dimension of thickness, assembling said plates irregularly in overlapping relation but having their opposite flat faces disposed substantially horizontally, to thereby position the plates forming the opposite flat faces of the resulting corkboard in substantial parallel alignment with one another and compressing and bonding said plates to one another to form corkboard.

Diethylene Glycol Esters of Abietic Acid. George M. Norman, assignor to Hercules Powder Co., of Wilmington, Del. U. S. P. 1,779,710; Oct. 28, 1930.

As a specific example of the production of the diethylene glycol ester of abietic acid, 60 parts of diethylene glycol, boiling point about 245° C. and 300 parts of rosin of color grade H, acid number 162, and which may be a gum rosin or a purified wood rosin, are heated under atmospheric pressure to say 250° C. to 260° C., in the presence of 5 parts of a catalyst, which may be zinc dust, boric acid, or the like. The heating is continued for about five hours, a short air condenser being used during a part of the heating period to permit the escape of water. After about ten hours further heating, the reaction is substantially completed; the temperature of the mass is then raised to about 300° C. and the pressure reduced to about 15 mm. of mercury in order to distill off the low end of rosin and any excess of diethylene glycol, etc. which may be recovered by condensation. The residue, about 270 parts, will constitute the diethylene glycol ester, having an acid number of 22, grading E in color and having a melting point of about 60° C.

Comb. Archibald D. McKellar, of Park Ridge, Ill. U. S. P. 1,780,206; Nov. 4, 1930.

In the construction of a comb of the class described, the process of forming a blank having one edge serrated to correspond to the points of the teeth, the opposite edge to correspond to the outer edge of the back or handle, and the ends to correspond to the outer edges of the end teeth; cutting the said blank from



the points of indentation by a number of parallel cuts of adopted length, made intermediate the ends to form strips of tooth form, attached to the back or handle thereof; and bending an inner part of each of the said strips adjacent the back or handle thereof to form curved base portions to position the teeth in rows, and to provide tortuous transverse passageways.

A comb comprising a back portion, a plurality of teeth having longitudinal scrapping ridges disposed lengthwise their body portions, and curved base portions projecting alternately and oppositely from said back, the said body portions being arranged in two longitudinal rows in spaced relation, having transverse passageways between the teeth and the said ridges projecting into the transverse passageways.

Heat Plastic Rubber Composition. Harold Gray, assignor to the B. F. Goodrich Co., of New York, N. Y. U. S. P. 1,782,036; Nov. 18, 1930.

It has heretofore been proposed to utilize rubber isomers as a bonding agent between rubber and other materials and in one method of this use it is the practice in making composite constructions comprising rubber to coat the contacting surfaces of the rubber or other material, or both, with the rubber isomer, subject the assembled product to pressure and to elevated temperatures, both for the purpose of vulcanizing the rubber and for effecting the adhesion between the component parts of the article.

The present invention is based upon the discovery that if the rubber isomer is admixed with small percentages of materials of various kinds which give to the rubber isomer a greater tensile strength and resistance to flow when hot, the articles need not be cooled under pressure. I have found that the following materials, which fall into no well recognized chemical class but which may be considered to constitute an empirical group, accomplish satisfactorily the hereinabove described purpose: lead, oleate, lead linoleate, lead palmitate, lead stearate, lead benzoate, lead acetate, lead carbonate, lead chromate, lead chloride, tetra methylthiuram disulfide, tetra ethyl diamino disulfide, mercury oleate, aluminum oleate, sodium oleate, magnesium oleate, manganese linleate, combalt linoleate, potassium, palmitate, postassium stearate, blue lead, tellurium, selenium, casein, wood flour, gluten, graphite, asbestos, powder, antimony sulfide, manganese dioxide.

Sulfur Plastic. Marc Darrin, assignor F. N. Burt Co. Ltd., of Toronto, Canada. U. S. P. Re. 17,867; Nov. 11, 1930.

A composition of matter comprising approximately from 20% to 35% cellulose, the remainder being chiefly sulphur and containing an introfier, the composition possessing properties of hardness and strength, impermeability and resistivity, being a nonconductor of electricity and capable of being machined.

The process of impregnating which comprises subjecting a porous article to the action of molten sulphur at atmospheric pressure and removing the article while at a temperature slightly in excess of the temperature of maximum fluidity of the sulphur without altering the pressure whereby the excess sulphur adhering to the surface upon removal is absorbed into the fibres.

Molding Machine. Albert William Sizer, of Hessle, England. U. S. P. 1,782,322; Nov. 18, 1930.

A continuous molding machine for plastic material comprising in combination a compression chamber, a die plate closing said chamber, a feed worm body mounted to rotate within said chamber of lesser diameter than said chamber for the major proportion of its length, a shallow helical flange on said feed worm body emerging at the delivery end into a flange of diameter equal to the internal diameter of said compression chamber.

Molding Mica and Machine Therefor. Louis T. Frederick, assignor to Continental Diamond Fibre Co. U. S. P. 1,782,989; Nov. 25, 1930.

In a device of the class described, a mold for configurating flat elements, a conveyor for carrying said elements to the mold, means for holding the flat elements accurately positioned on the conveyor, and means associated with the mold for arranging the flat elements in position during the configurating operation.

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The process of making pressed mica products which comprises, forming a plurality of flat mica elements, arranging a film of binder between adjacent elements, heating elements in a chilled mold to form a pressed article and scrap and separating said article from the scrap.

Mixed Esters of Colophony. Herman Alexander Bruson, assignor to the Resinous Products & Chemical Co., a Corporation of Delaware. U. S. P. 1,783,165; Nov. 25, 1930.

30 parts by weight of colophony are mixed with 15 parts of sebacic acid and 5 parts by weight of glycerol. The mixture is rapidly heated to 195-200° C. with stirring and kept at this temperature for about twenty minutes. The temperature is then increased to 250-260° C. and kept thereat for one hour until esterification is complete and a benzol-soluble ester results. The mixed ester thus obtained is tough and flexible, soluble in ethyl acetate. By increasing the in ethyl acetate, toluol, or butyl acetate. By increasing the proportion of colophony the mixed ester can be obtained with an increased degree of hardness.

Rubbery Condensation Product. Herman Alexander Bruson, assignor to the Resinous Products & Chemical Co. U. S. P. 1,783,168; Nov. 25, 1930.

Example 1

Equi-molecular quantities, namely, 40.4 grams sebacic acid, 56.4 gr. oleic acid and 19 gr. glycerol are mixed together and heated in an open vessel with stirring, first at 170° C. for four hours and finally at 230° C. for 2 hours. A very viscous sirup is obtained, which is soluble in toluene, butyl acetate, or butyl alcohol. The sebacic acid may be replaced with 29.2 gr. adipic acid if desired.

Example 2.

Equi-molecular quantities, namely, 40.4 gr. sebacic acid, 56.5 gr. stearic acid and 19 gr. glycerol are heated together at 230° C. for 5¼ hours. The product is a tough, rubber-like plastic solid, soluble in toluol, gasoline and butyl acetate. The sebacic acid may be replaced with 37.6 gr. azelaic acid, if desired.

Several other examples are given.

Aldehyde Amine Condensation Products. Waldo Briggs Burnett and Ira Williams, assignors to E. I. Du Pont De Nemours & Co., of Wilmington, Del., a Corporation of Delaware. U. S. P. 1,780,334; Nov. 4, 1930.

Example 1.—36 parts of n-butyraldehyde, rendered acid free by treatment with dilute aqueous solution of sodium hydroxide and subsequent careful washing with water were added to 9.3 parts aniline, that is to say in the proportion of five molecules of normal-butyraldehyde to one molecule of aniline. A vigorous reaction ensued, heat was evolved, water was formed and separated from the reaction mixture. The mixture was then heated at reflux. The

reflux condenser was arranged to separate the water and to return the other refluxing substances to the reaction vessel. The mixture was refluxed on successive days for a total of 24.25 hours. After the mixture had been refluxed for this period of time there was no apparent increase in the amount of water formed and the reaction product had reached the temperature of 165° C. The resulting product was a light reddish brown, quite mobile liquid having a characteristic odor. It was insoluble in water but was easily soluble in alcohol, benzene and other organic solvents. When used in a compound composed of 100 parts of rubber, 3 parts of suulfur, 5 parts of zinc oxide, 25 parts of gas black and 1.0 part of this product, is produced a tensile strength of 1710 lbs./inch^2 when vulcanized at a temperature of 140° C. for 30 minutes.

Aldehyde Amine Condensation Product. Ira Williams and Waldo Briggs Burnett, assignors to E. I. Du Pont De Nemours & Co., of Wilmington, Del. U. S. P. 1,780,326; Nov. 4, 1930.

Example 1.—Forty-five and six-tenths parts of heptaldehyde are added to 14.6 parts of n-butyl amine, that is to say, in the proportion of two molecules of heptaldehyde to one molecule of n-butylamine. A vigorous reaction ensues, considerable heat is evolved, water is formed and separates from the reaction mixture. As the reaction becomes less vigorous the mixture is heated at reflux. After refluxing the mixture for about 4 hours there is no apparent increase in the amount of water formed. The reaction mixture is then cooled and dried over anhydrous sodium sulfate after which is decanted off. The resulting condensation product is a light reddish brown, quite mobile liquid having a characteristic but not unpleasant odor. It is insoluble in water but is easily soluble in alcohol, benzene and other organic solvents.

22 examples are given. The product will vulcanize rubber while same are resinous.

Amongst the various condensation products which have been prepared and which are believed to have valuable properties are the following:—acetaldehyde aniline (5:1) (a dark reddish-brown, brittle, non-crystalline solid); n-butyraldehyde guanidine (5:1) (a viscous orange liquid); n-butyraldehyde methyl amine (5:1) (a reddish brown liquid);; n-butyraldehyde ethyl amine (5:1) (a reddish-brown liquid); n-butyraldehyde diethyl amine (5:1) (a light reddish-brown liquid); n-butyraldehyde ethylaniline (5:1) (a reddish brown liquid); n-butyraldehyde methylamine (10:1) (a reddish brown liquid); n-butyraldehyde ethylene diamine (10:1) (a reddish brown liquid); n-butyraldehyde ethyl amine (15:1) (a reddish-brown liquid); heptaldehyde ethyl amine (5:1) (a reddish-brown liquid); heptaldehyde o-tolyldiguanide (5:1) (a light reddish-yellow, very viscous and very sticky liquid, showing a greenish-yellow fluorescence); acetaldol ethylamine (5:1) (a red-

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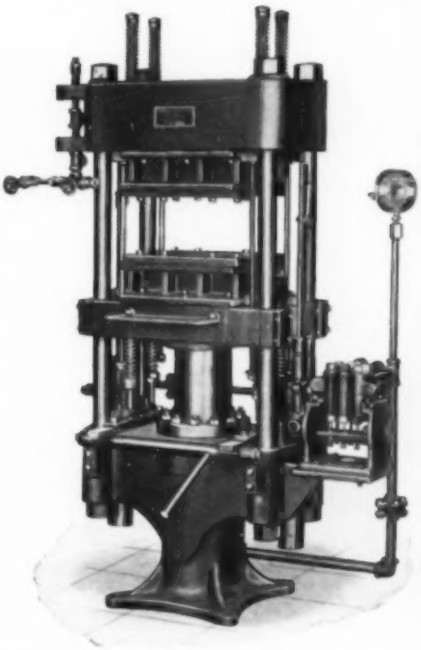

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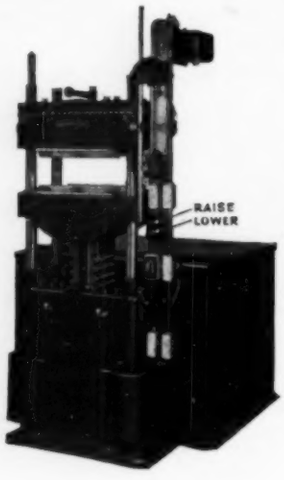

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dish-brown semi-solid very much like ethylidene aniline in appearance); acetaldol o-tolyldiguanide (5:1) (a reddish-yellow, brittle, non-crystalline solid); crotonaldehyde aniline (5:1) (a dark reddish-brown, brittle, non-crystalline solid); citralo-tolydiguanide (5:1) (a reddish-yellow, very viscous, and very sticky liquid, showing a greenish-yellow fluorescence).

Resinous Condensation Product. André Henri Victor Durr, assignor to Compagnie Nationale De Matieres Colorantes et Manufactures de Produits Chimiques du Nord Reunies, Etablissements Kuhlmann, of Paris U. S. P. Re. 17,878; Nov. 25, 1930.

450 parts of linseed oil are placed in a well stirred autoclave together with 450 parts of resin prepared as described in Example I of my said Patent No. 1,739,446, to wit, by adding a mixture of phthalic anhydride and colophony (acid value=162.5) to glycerine, the proportions being 285,-200 and 240 parts respectively, at 110°, raising the temperature to 260° in 15-20 hours, and after maintaining the reaction mixture at this temperature for 2 hours, running the product off. The mass of oil and resin is heated for 160 hours at 210°. The pressure rises to 5 or 6 kilos.

The mass is then left to cool at 50°-60° and tests made to ascertain if it be completely homogeneous. If it does not happen to be so, it is heated again for 8 hours at 250° and longer if necessary.

The mass is in a viscous form at the ordinary temperature, of a greenish yellow colour, slightly fluorescent.

This example is not restrictive with regard to the proportions of siccative oil, and resins, the nature of the resin and of the siccative oil, the duration and temperature of the heating which are naturally variable with the resin or mixture of resin used and the product desired.

Condensation Products from Unsaturated Higher Fatty Acids and Phenols. Alfred Thauss, of Cologne-Deutz, Arnold Doser of Cologne-Mulheim, and Gustav Mauthe, of Cologne-Holweide, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, of Germany. U. S. P. 1,779,345; Oct. 21, 1930.

Example 1.—50 parts by weight of phenol are dissolved in 60 parts by weight of China wood oil and 60 parts by weight of sulfuric acid of spec. grav. 1.30 are added. The mixture is emulsified by means of a rapid stirrer and is kept for about 8 to 10 hours at the temperature of the water-bath, until the smell of wood oil has disappeared and a sample is easily dissolved to form a clear solution in dilute boiling sodium carbonate solution or in pure water, after treatment with sodium carbonate. When the sulfuric acid and any still adhering traces of phenol have been washed out, the reaction product remains as a slightly colored odorless mass with a salve-like consistency.

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Hedley, Barry T.—The Natural and Synthetic Resins	1926	203	5.50
Condensed Chemical Dictionary	1930	528	10.00
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Other books quoted on request.

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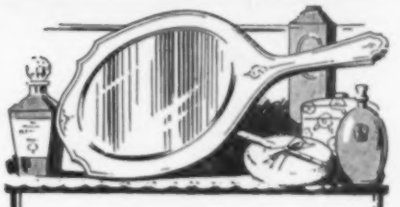

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And Now, In Closing:

WE move that a certain hotel be renamed the General Plastics Brock . . . even though the molders will disclaim all responsibility for the rock slide at Niagara Falls . . . American Insulator is anxious to dispose of the aeroplane . . . they had better wait until business picks up a little by itself . . . Bill Johnson of Stokes-Smith was seriously injured early in January in an automobile accident at Stroudsburg . . . he is still in the hospital there . . . none of the raw material people attended the Molders Meeting, but Beetle was on display at the drugstore in the Statler . . . The grippe epidemic has hit the industry pretty hard . . . it laid up, among others, Donald Dew and Douglas Woodruff . . . Al Hanmer will be down in New York permanently for Durez starting February . . . we understand that Richardson (Chicago) have their eye on making their own . . . Celluloid is undergoing an extensive change in personnel . . . A. C. Grunow has been relieved of the presidency of the Grigsby-Grunow Company and the Majestic Household Utilities Corporation . . . B. J. Grigsby succeeds him . . . According to our figures, the molders should be glad they were not selling presses during 1930 . . . We hear that Watson-Stillman have been sustained in their patent litigation against the Duo-Press . . . Again we omit any business review from this page . . . there is a good deal of it way back in the book. . .

RADIO fans may or may not have heard the technical discussion of Celluloid that was on the air from the National Broadcasting Company during the KUKU hour, the night of December 30. In order to preserve it for posterity, we reprint exactly as it was delivered, by permission, of its author and conductor, Mr. Raymond Knight.

An excerpt from that Great Nickelodeon Feature, a five-reeler entitled:

You May Have Your Turtle Soup and Wild Game Courses, But Give Me That Great Arabian Desert

An English tailor is pressing on and on into the African jungle, accompanied by his fair-haired, and black and blue eyed daughter, Excelsior—a wisp of a girl. They are headed for the little-known country of Papamama. Finally they arrive at the Papamaman capitol, Ping Pong. The following alleged dialogue takes place:

DAD: Eureka, Excelsior—it is our destination—this is Ping Pong.

EX: Ping Pong! How thrilling—this is where the great celluloid forests are.

DAD: No, dear—Celluloid comes from the tusks of jailephants.

EX: Jailephants?

DAD: Yes, dear. You see, celluloid comes from cellulose, which is composed of many small cells. We take elephants and put them in prison, and by raising them in the cells we cross the ivory with the cells and get celluloid tusks—that's why we call 'em jailephants.

EX: And it is brought all the way to our country?

DAD: Oh yes—it is far fetched.

EX: So is the explanation, daddy.

IN connection with our other publication, CELLULOSE, we receive every week copies of the Weekly Business Review of the American Pulp & Paper Association. We do not know who is responsible for the sound sentiments contained in many of their articles, but we have preferred them many times to the paid scribblings of political penpushers. In our admiration we would like to pass some of the thoughts along to our readers and shall, therefore, with their permission, devote the balance of our space this month to excerpts from these bulletins.

IN strained business periods price takes on a greater importance than it ordinarily has: it becomes too frequently the sole criterion of sale. Price has this effect when it shows weakness, particularly when the whole price structure weakens.

It may be that this is the psychological result of the shift from the sellers' to the buyers' market. In a so-called sellers' market price is important, but quality, service and many other sale determinants influence buyers. Then purchasers do not seek so persistently to obtain favored prices for they realize that sellers are not under extraordinary pressure to sell; rather they seek the greatest value.

But when conditions are reversed, buyers incline to disregard everything except price. And in the race-like search for low prices offers from strange sellers are entertained. The resultant transactions may be acceptable in all respects; and they may not be.

Too frequently this process is repeated until prices once shaken from their level, remain low so long that both buyers and sellers are completely fed up and willingly return to a normal and a stable form of business.

Normal business in America has long been on a plane of mutual confidence. Relations between a normal buyer and a normal seller do not vary from these standards no matter whom the conditions of the moment may favor. Prices may sag but the quality of the goods and of the service remains unaffected.